DEVELOPMENT OF TECHNIQUES AND PROCEDURES FOR EVALUATING THE OBJECTIVES OF THE SIXTH GRADE SCIENCE PROGRAM IN THE ELEMENTARY SCHOOLS IN MANILA

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TABLE OF CONTENTS

Page

ACKNOWLEDGMENTS iii

CHAPTER

I INTRODUCTION 1

The Need for the Study 5
Statement of the Problem 8
Methodology 8
Definition of Terms 12
Limitations of the Study 13
Outline of the Dissertation 13

II STATEMENT AND COMPARISON OF THE GENERAL OBJECTIVES SUGGESTED IN THE PHILIPPINE SIXTH GRADE COURSE OF STUDY WITH THOSE FOUND IN THE LITERATURE OF THE UNITED STATES 14

The Need for Stating Our Goals in Terms of Specific Pupil Behavior 23

III EVALUATIVE TECHNIQUES AND PROCEDURES SUGGESTED IN THE LITERATURE AND RESEARCH 27

Testing Procedures 28
Non-Testing Procedures 59

IV PROBLEMS, SPECIFIC CONTENT OBJECTIVES, AND SUGGESTED EVALUATIVE TECHNIQUES AND PROCEDURES FOR THE FOURTEEN TEACHING UNITS SUGGESTED IN THE SIXTH GRADE PHILIPPINE COURSE OF STUDY 79

Experience Area 1 - Plants and Animals 82
Experience Area 2 - The Weather 99
Experience Area 3 - The Earth and Beyond 101
Experience Area 4 - Ways and Means 105
Experience Area 5 - The Human Body and Its Care . . 109

Page

V BEHAVIORAL GOALS THAT PERMEATE THE FIVE MAJOR EXPERIENCE AREAS SUGGESTED IN THE PHILIPPINE COURSE OF STUDY 142

Behavior Goals that Permeate Each of the Major Experience Areas Suggested in the Philippine Course of Study 145
Evaluative Techniques and Procedures 148

VI SUMMARY, CONCLUSIONS, RECOMMENDATIONS 159

Summary 159
Conclusions 163
Recommendations 169

APPENDICES 172

BIBLIOGRAPHY 308

BIOGRAPHICAL SKETCH 320

CHAPTER I

INTRODUCTION

Compared to the three R's, science is a newcomer to the elementary school program in the Philippines. Yet the teaching of science has made progress in our time. Each year brings new changes, more materials, and better ways of teaching that contribute to the improvement of the elementary science program.

The purposes and objectives of teaching science, both in the Philippines and in the United States, have expanded and become broader in recent years. Factual learning is no longer accepted as the paramount aim of science instruction. The teaching of elementary science has progressed far beyond that simple concept of learning. It is no longer considered adequate for pupils to be able to reproduce or recite facts, important as they are. How facts change children's behavior is really the important factor in learning. The usefulness of facts should not be limited to the particular science period in which they are "learned." On the contrary, the information "learned" must influence children's thinking and acting. They must be able to use this information to make adequate adjustment to life situations.

The two major aspects of science -- science as a body of systematized knowledge and science as a process -- are now assuming equal importance in the elementary schools of Manila, whereas in the past the first has been overstressed at the expense of the second. While it is considered important for certain science facts, concepts, and generalizations to be a part of basic education, it is, at the same time, equally essential for children to learn the methods scientists use in solving problems and acquiring information. During the past years the science program in the elementary schools in Manila was concerned primarily with a few observation lessons, identifying and classifying things, and reproducing facts read from science books. The use of experimental approach and problem solving methods was thought to be too advanced for elementary school children. Today, however, the elementary science program has been expanded to encourage the children to make and compare their observations, to use the scientific approach in studying materials and in solving problems at their level. We find that through meaningful science experiences elementary school children can carry out simple experiments and proceed systematically to solve problems that are significant to them.

Recently there have been attempts to organize science in the elementary schools around concepts and generalizations. The acquisition of science facts is important but educational research in the United States, such as that reported by Nelson (1), Oakes (2), and Smith and Anderson (3), has shown that the retention of concepts or generalizations is greater than that of factual information. The crucial test of good science teaching is not whether children retain minute details of information, but how well they put these facts together and use the information in interpreting their environment and in solving problems.

Now, greater emphasis is placed not only on the development of science concepts, generalizations, and understandings, but also on the stimulation and development of desirable attitudes, skills, interests, and appreciations. In one recent investigation, scientific attitudes, interests and appreciations were rated as being the most important objectives (4). Smith and Anderson (3) believe that at the elementary level the impact of the instruction process on attitude development is likely to be more effective than at later stages in the life of the child.

These changes and developments in science education indicate signs of healthy growth in seeking to develop school programs which will more nearly meet the needs of our children and of our society. In view of these recent trends we have attempted to use better instructional materials, develop teaching guides and procedures that change the emphasis on the teaching outcome. We are exerting much effort to follow through with teachers to make certain that they understand the objectives and reflect them in teaching. In the light of these changes, it is necessary to appraise the products of our efforts. The purposes of such appraisals are to determine the growth of children toward the new goals which have been formulated as objectives of science education. These require a second look at the evaluative techniques we use in assessing progress towards the objectives of our science program. Do our evaluation procedures and devices meet the challenges brought about by the new developments and changes in teaching science?

Our evaluative procedures and instruments are as important as our teaching. They should reflect the image of science we want to communicate to our children. Since the objectives of science education have expanded to include behavior goals, the days have passed when tests of mere factual memory were sufficient. It seems beyond question that instruments limited largely to memorization will not assess all of the objectives of science instruction. We should develop other techniques that will help teachers appraise varied teaching outcomes. The instruments should tell the teacher a great deal about the pupil: his interests, attitudes, methods of approach to problems, his skills, his appreciations and more.

Stated objectives will be ignored by teachers and students unless evaluative practices reflect those objectives with sincere attempts at measurement. A pupil will seek to learn and develop study habits in keeping with what he expects he will be evaluated on. If past experience has shown him that measurement of his learning will be limited to memorization of factual information, then that will determine his focus of study. On the other hand, if he anticipates, he will be evaluated on the acquisition of concepts and behavioral goals, he will redirect his study habits and learning foci. Likewise, the morale of teachers is also threatened when they are asked to teach for the attainment of certain objectives if techniques for measuring the achievement of those objectives are not available. This is particularly true when teachers are told that certain objectives are no longer of primary importance, yet conventional testing procedures are continued in use to check on how well these traditional goals are achieved. Since the aims of education form the basis for appraisal, they must also give it direction. Evaluation must be as broad and varied as the educational objectives from which it springs.

There is great need for improved evaluative techniques in science education. Reiner (5) specifically calls attention to the importance of investigating informal evaluative techniques that go beyond paper and pencil tests, of improving the quality of teacher-made tests, of discovering ways of measuring the influence of science education upon pupil behavior and of devising more effective tests of ability to think critically.

Authorities are agreed that in general, the research needs in the field of science education continue to be (a) improved procedures for identifying the significant educational outcomes and translating them into observable student behaviors; (b) improved devices for appraising these student behaviors -- improved in the sense of being more valid, more reliable or more administratively feasible; (c) improved ways of integrating the results of these appraisals into a comprehensive evaluation of a pupil (6).

The lack of adequate techniques for appraising important science outcomes makes it necessary for teachers, principals, and supervisors to improve existing methods of appraisal or to devise new and more effective means. Until this is done, the discussion of or setting up of more significant objectives in elementary science will be largely a waste of time and effort.

The Need for the Study

The problem of evaluating effectively the results of science teaching has presented difficulties not only to classroom teachers but also to principals and supervisors of the public schools in Manila. One of the difficulties encountered lies in the lack of evaluative instruments and procedures available to classroom teachers. Evaluation techniques carried out in the schools at present are mostly confined to pencil and paper testing. If science teaching at the elementary level aims at changes in behavior, it cannot settle for shoddy goals such as covering suggested units in the Course of Study or learning certain materials for a test. What the child learns must be part of him and must be translated into his thinking and actions if he is to grow towards the objectives of the science experiences.

At present, it is not unusual to find pupils in science classes who can glibly discuss the uses and importance of trees, who can recite important health rules, who can talk about comets and the causes of eclipses but still injure the barks and branches of trees, fail to wash their hands before eating, and believe superstitions alluding to the appearance of comets and the occurrence of eclipses. Has the science information acquired influenced thinking? Has it made a difference in behavior? Are the children achieving growth in the right direction? Are teachers succeeding in their teaching? It is this part that makes evaluation in science difficult, for as yet we have very few instruments adequate to measure growth in attitudes, appreciations, ability to think and to solve problems, and similar intellectual equipment. As Bloom says, "much research and experimentation must be done in the field of evaluation, and some of this can best be done with the help of classroom teachers who will contribute their daily classroom experiences."(7,p93)

If continued improvement in the quality of teaching in elementary science is to be achieved, there is a pressing need to develop more effective means of evaluation. The development of teaching techniques and evaluative techniques must move forward hand in hand. Progress in one cannot be achieved on a permanent basis without concomitant progress in the other.

Much remains also to be done to put into actual use the achievements of science in improving our living conditions. As yet, there is still a considerable portion of the city population, especially in the slum districts, which has not fully learned to appreciate the value of sanitation and the contributions of science to their daily living. There are still many people who are not taking advantage of the services of licensed physicians or of the free dental and medical services offered at the puericulture centers and hospitals. They refuse inoculation, avoid medical checkups, buy and take medicine without doctors' prescriptions, and refuse hospitalization even when they are sick with communicable diseases. Although poverty may be the main cause, these conditions also show that mere knowledge of facts is not enough. Besides the facts themselves, pupils must know how to use them. Scientific knowledge is of no value if it is not used in the solution of problems of everyday living and translated into desirable behavior. This is a great challenge for schools. Teachers need to evaluate with greater accuracy how effectively pupils act on the basis of their knowledge and concepts -- how much their behavior is influenced by instruction. While this behavior includes correct responses on tests, it also includes the day to day actions of pupils in and out of school Teachers need some techniques and procedures that will help them appraise pupils' growth in scientific attitudes, in problem solving and other skills, in science interests, habits, and appreciations. This calls for a more careful and a more extensive evaluation than is now being done in our public schools.

Statement of the Problem

The major purpose of this study has been to develop techniques and procedures for evaluating growth toward the objectives of the sixth grade science program in the elementary schools in Manila. In this study the writer has attempted to answer the following questions.

1. How do the general objectives suggested in the Philippine sixth grade course of study compare with those found in the literature in the United States? What additional objectives found in the literature will improve and enrich the present sixth grade science program in Manila?

2. How can the general science objectives for the sixth grade science program of Manila be stated in terms of content and specific pupil behavior?

3. What evaluation techniques and procedures are suggested in the literature and research?

4. Which of these and what other techniques and procedures may be developed to help teachers appraise the growth of pupils toward the objectives of the science experiences?

5. What paper and pencil instruments can be developed which will measure children's acquisition of science knowledge, ability to think critically, solve problems scientifically and determine evidences of growth towards the development of desirable attitudes, habits, interests, and appreciations?

Methodology

1. The first step taken in this study was to state the general goals for teaching science found in the sixth grade Philippine Course of Study and to compare these goals with those found in the literature of the United States. From this comparison, additional objectives found in the literature which would improve and enrich the present sixth grade

science program in Manila were suggested.

The set of goals formulated were of two types -- helping children learn basic science information and developing desirable behaviors in the process. The former was used as a guide for developing more specific content objectives while the latter was used as a framework for developing more specific behavioral objectives.

2. To determine the specific content objectives, the units suggested in the course outline which have been selected to achieve the general objectives were studied. Problems pertinent to the study of each unit and which children are likely to raise were anticipated. Basic science information which needs to be taught to help children solve the problems were listed. These facts, concepts, generalizations or principles were stated in terms of specific content objectives for each of the 14 units suggested in the Philippine Course of Study. The problems and objectives are found in Chapter IV.

After the specific content objectives for each unit were determined, the general goals which aim to develop desirable behaviors were stated in terms of more specific behavioral objectives. These are the 14 behavior objectives found in Chapter V. Specific pupil reactions indicative of each behavior were compiled and listed under each behavior to make these objectives more meaningful and easier to evaluate.

In addition to the activities suggested in the Philippine Course of Study, additional experiences which will help attain both content and behavioral objectives were worked out. While these activities and the materials suggested are important parts of the units developed, they were not considered a vital part of the report of this study and were therefore not included.

3. To provide effective means for appraising the achievement of the specific content and behavioral objectives, a survey of evaluative techniques and procedures suggested in the literature was made. To make the discussion of the devices and methods clear, some of the content of the Philippine Course of Study was used in the illustrations.

4. From the findings of the survey, devices, techniques, and procedures appropriate for evaluating pupil growth towards the specific content objectives were selected, adapted, and developed. Sample objective and essay tests and non-testing procedures were devised and organized by experience areas. These are found in the Appendix under the following headings:

Appendix A — Evaluative Devices for Experience Area 1 Plants and Animals. This area includes the following related units:

Unit I - Trees Around Us
Unit II - Our Aquatic Animals: Their Protection and Conservation
Unit III - Our Work Animals
Unit XI - Birds and Fowls
Unit XII - Air Plants
Unit XIII - Plants for Food
Unit XIV - Useful and Harmful Insects

Appendix B -- Evaluative Devices for Experience Area 2 The Weather. This area covers Unit IV -- Air and Its Importance to Life.

Appendix C -- Evaluative Devices for Experience Area 3 The Earth and Beyond. This area includes Unit VI -- The Universe, Our Solar System.

Appendix D -- Evaluative Devices for Experience Area 4 Ways and Means (Practical, Mechanical, Electrical). This area covers Unit V -- Common Mechanical and Electrical Devices Used in the Home and Industry: Heat and Light.

Appendix E — Evaluative Devices for Experience Area 5 The Human Body and Its Care. This area includes the following related units:

Unit VII — Safety First: First Aid
Unit VIII — The Right Kinds of Food: Their Selection and Preparation
Unit IX — Body Structure and Growth
Unit X — Communicable Diseases and Other Illnesses Affecting the Different Organs of the Body

A coded listing of evaluative devices and procedures which may be used for evaluating each specific content objective is given at the end of each of the 14 units found in Chapter IV.

5. From the findings of the survey, techniques and procedures appropriate for evaluating pupil growth towards the specific behavioral objectives were also selected, adapted, and developed. Since behavioral objectives can only be evaluated in terms of the specific pupil reactions indicative of each behavior, evaluation instruments and procedures that will help teachers determine the presence or absence of each desirable reaction indicative of each behavior goal were devised. These suggested instruments and methods of appraisal are found under Appendix F — Evaluative Devices and Procedures for Appraising Growth Towards the Specific Behavioral Objectives that Permeate the Five Experience Areas Suggested in the Philippine Course of Study.

A coded listing of the suitable evaluative devices and procedures which may be used in determining growth towards each of the desirable behavior reaction is found in Chapter V.

6. A summary of the study, conclusions arrived at and recommendations for further study are given in Chapter VI.

Definition of Terms

The definitions of the following terms are either direct quotations from or modifications of those found in the Dictionary of Education (8). Modifications were made in order to make them more meaningful to our teachers.

Evaluation means the "consideration of evidence in the light of value standards and in terms of the particular situation and the goals which the groups or individual are striving to attain."

Informal evaluation applies to the "appraisal of an individual's status or growth by means other than standardized instruments."

Measurement refers to the "general study and practice of testing, scaling, and appraisal of aspects of the educational process for which measures are available and of the individuals undergoing the educational process."

General objective means aim, end in view, or purpose of a course of action or a belief which serves to select, regulate, and direct later aspects of the act so that the total process is designed and integrated.

Specific objective is "a goal or aim serving as a guide for a teaching unit, directed toward the eventual achievement of a general objective and stating preferably in exact terms, the results that may be expected from that particular unit of instruction."

Technique is "a process, manipulation, or procedure required in any study, activity or production."

Behavior as used in this study means anything that a pupil does, including overt, physical action, internal and emotional processes and implicit mental activity.

Concept is a generalized idea including all that is suggested to the individual by an object, phenomenon or situation. It is seldom if ever acquired in final form on one occasion but the individual often goes through a process by which its meaning is enriched by several experiences.

Understanding is defined as the mental power, faculty, or function whereby the meaning of phenomena or propositions are apprehended.

Skill refers to "anything that the individual has learned to do with ease and precision; may be either a physical or a mental performance."

Scientific attitude implies such qualities of the mind as intellectual curiosity, passion for truth, respect for evidence and an appreciation of the contributions of science to daily living.

Interest is defined as preoccupation of an individual with problems or activities originating in observations and experience when the individual is free to choose.

Appreciation refers to an "emotionally fringed awareness of the worth, value or significance of anything."

Limitations of the Study

1. This study will be limited to the evaluation only of the objectives of the sixth grade science program in the public elementary schools in Manila.

2. No attempt will be made to revise the Course of Study as it now exists.

Outline of the Dissertation

Chapter I.	Introduction.
Chapter II.	Statement and Comparison of the General Objectives Suggested in the Philippine Sixth Grade Course of Study with Those Found in the Literature of the United States.
Chapter III.	Evaluative Techniques and Procedures Suggested in the Literature and Research.
Chapter IV.	Problems, Specific Content, Objectives and Suggested Evaluative Techniques and Procedures for the Fourteen Teaching Units Suggested in the Sixth Grade Philippine Course of Study.
Chapter V.	Behavioral Goals that Permeate the Five Major Experience Areas Suggested in the Philippine Course of Study.
Chapter VI.	Summary, Conclusions and Recommendations.
Appendices	Evaluative Devices

CHAPTER II

STATEMENT AND COMPARISON OF THE GENERAL OBJECTIVES SUGGESTED IN THE PHILIPPINE SIXTH GRADE COURSE OF STUDY WITH THOSE FOUND IN THE LITERATURE OF THE UNITED STATES

Evaluation of children's growth is an integral part of teaching science. It reflects objectives that are in part determined by the philosophies of those who teach the subject as well as by a study of trends in science teaching. It is hardly possible to develop evaluative techniques and procedures without first clarifying the objectives they intend to measure. As the first step in accomplishing the major purpose of this study, it was found important to state clearly the general objectives suggested in the Grade VI Course of Study in Elementary Science used in the Philippines. These objectives provided the framework for appraising the results of the science experiences given to the children. It was also desirable to compare these objectives with those proposed in the United States literature. From the comparison, a pattern was discerned which helped to clarify the ideas of the purposes of science teaching to young children.

To make the comparison, the writer surveyed the literature and read (1) selected science courses of study, (2) professional books in science education, (3) studies conducted by national committees on the objectives of elementary science, (4) science books for children, and (5) current literature such as reports of surveys conducted and periodical articles.

The general objectives proposed in these sources were summarized and grouped under two categories -- those that permeate other subject areas and those that are specifically science objectives. Table 1 presents these objectives together with the major goals suggested in the Philippine Course of Study. The list was studied and the general objectives that were commonly proposed in the various sources cited were selected and made the basis for determining the content and specific pupil behavior objectives.

Table 1

General Objectives in Elementary Science Suggested in the Philippine Course of Study and in the United States Literature

	Philippine Course of Study	Proposed in Science Education								
Objectives	9	15	16	17	18	19	20	21	22	23
A. Specific science objectives										
1. To help children										
a. learn basic scientific										
1) knowledge and facts	x	x	x	x	x	x	x	x	x	x
2) generalizations or principles	x	x	x	x	x	x	x	x	x	x
3) concepts			x	x			x		x	x
b. develop and appreciate science methods as a way of thinking and solving problems	x	x	x	x	x	x	x	x	x	x
c. develop science attitudes	x	x	x	x	x	x	x	x	x	x
d. develop interests	x	x	x	x	x	x	x	x	x	x
e. develop appreciations	x	x	x	x	x	x	x	x	x	x
f. recognize the inter-relationship of science with all human experience		x	x				x			x
2. To introduce and give children experience in scientific investigation	x	x	x	x	x	x	x	x	x	x
3. To teach experimental or discovery approach				x						
4. To encourage desire for specialized pursuit of science										

Table 1 - Extended

Proposed by National Committees					Proposed in Science Books for Children						Proposed in Selected Courses of Study						Proposed in Reports of Surveys and Periodical Articles				
10	11	12	13	14	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x			x	x	x			x	x	x	x	x	x	x	x		x	x	x	x
x		x	x			x	x	x	x								x				
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x							x	x	x												
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x																					
x							x														

Table 1 - Continued

Objectives	Philippine Course of Study	Proposed in Science Education								
	9	15	16	17	18	19	20	21	22	23
5. To help children increase understandings of themselves and of their relationships to their universe		x	x	x	x	x	x	x	x	x
6. To understand that change, a cause and effect relationship, has been, is, and will continue to be a fundamental phenomenon in the universe in which we live		x	x				x		x	x
B. Science objectives that permeate other subject areas										
1. To help children										
a. develop fundamental skills	x	x	x	x	x	x	x	x	x	x
b. acquire personal values	x	x	x	x	x	x	x	x	x	x
2. To satisfy basic needs of children	x	x	x	x	x	x	x	x	x	x
3. To prepare children for citizenship	x	x	x	x	x	x	x	x	x	x
4. To provide real experience	x	x	x	x	x	x	x	x	x	x
5. To develop world understanding										
6. To discover and develop creative minds				x						
7. To accept the challenge that society needs our best talents and wisdom		x	x	x	x		x		x	x

Table 1 - Extended

Proposed by National Committees					Proposed in Science Books for Children						Proposed in Selected Courses of Study						Proposed in Reports of Surveys and Periodical Articles				
10	11	12	13	14	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x		x	x		x	x			x	x						x					
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
															x					x	
x																			x		
								x	x												

From the review of the objectives found in the United States literature, certain significant facts have been gleaned.

1. The general objectives for teaching science tend to be broad. There is a trend toward emphasis not only in the acquisition of scientific knowledge and understandings but also on thought processes and in the methods of science. Behavioral correlates are emphasized.

2. Certain purposes for elementary science are widely accepted. While the objectives differed in the way they were stated or described, the ideas or thoughts expressed in them were in close agreement. The majority of sources used agreed upon helping children to:

   (a) learn basic science facts, concepts, generalizations or principles
   (b) develop and appreciate science methods as a way of thinking and solving problems
   (c) develop scientific attitudes, interests and appreciations
   (d) gain experience in scientific investigation
   (e) increase understandings of themselves and of their relationships to their environment
   (f) develop fundamental skills
   (g) acquire personal values
   (h) satisfy their basic needs
   (i) prepare for citizenship
   (j) gain real experience

3. There is a wide acknowledgement that science plays a major role in a democracy. In a democratic society citizens need scientific information to help them make important decisions. We need to help children understand the relation of science to everyday life.

4. There is greater recognition of the nature of children. Objectives selected were suited to the children's stage of development and were limited only to what can be attained. Basic concepts about child growth and development and their implications for science teaching have been considered in the selection of objectives.

5. There is a general trend to set forth objectives in specific rather than in general terms. Broad goals such as "developing skills and competencies" are broken down into more specific and defined descriptions like (1) to develop and appreciate science methods as a way of thinking and solving problems, (2) to help children increase understandings of themselves and of their relationships to their universe, (3) to teach experimental or discovery approach; (4) etc.

While there is a tendency to state general objectives in more specific terms they are still not specific enough to permit effective evaluation.

A comparison of the general objectives suggested in the Philippine Course of Study with those found in the United States literature show that:

1. Two of the general objectives in the Philippine Course of Study were among the widely accepted science objectives in the United States. These objectives are.
    - (a) to understand and appreciate the contributions of science to modern life
    - (b) to appreciate the value of the scientific methods and to learn to use them in dealing with the simple everyday problems of personal and social living
2. The rest of the general objectives in the Philippine Course of Study:
    - (a) to understand cause and effect relationships
    - (b) to appreciate the importance of protecting plant and animal life
    - (c) to learn to utilize natural resources wisely were found to be only a small part of the comprehensive listing of understandings, attitudes, interests, and appreciations that have been proposed in the literature in the United States for children to acquire.

In the light of the comparison made and of the review of the aims proposed in the literature in the United States, there seems to be a need for setting up broader objectives for the science program in Manila. Greater emphasis must be placed not only on the development of conservation behavior as expressed by the third and fourth objectives stated in the Course of Study, but also on the development of other desirable attitudes such as open-mindedness, curiosity, resourcefulness, critical-mindedness, accuracy, and intellectual honesty. We cannot assume that behavioral implications will be self-evident and that children will act in a manner consistent with the knowledge they have learned. Only those things toward which teaching is specifically directed are likely to be accomplished. To be sure, therefore, that conscious, deliberate, and continuing effort will be exerted by our teachers toward the accomplishment of these ends, provision must be made for the inclusion of these objectives in the course outline.

Greater stress needs to be given also on the development of skills and abilities -- both intellectual and manipulative. Science instruction has not only a great potential but also a responsibility to help develop in our children the skills by which knowledge may be acquired and tested.

The learning of science content must be reoriented to the development of basic concepts instead of memorizing facts or isolated bits of information. A child may be able to recall or state verbally facts or ideas he has learned, but unless he can comprehend the complete meaning of the pieces of information to the point that he can grasp the relationship among them, restate them in his own words, take action intelligently on the basis of the information, he has not gained concepts or understandings. The extent to which children have been helped to acquire useful concepts is one of the best measures of the effectiveness of science instruction.

Greater attention needs to be directed too, to the development of appreciations and interests on the part of our children. The study of science should not only contribute to the appreciation of science in the modern world but it must also generate in our children an awareness of the wonders of the world -- of the beauty of color, pattern, rhythm, shape, and harmony in their environment.

In view of the results of the survey and the comparison of objectives made, there seems to be a need for expanding the scope of science objectives in the elementary schools of Manila. The purposes of teaching science might be stated as follows:

1. To learn basic science facts, concepts, generalizations or principles.
2. To develop and appreciate science methods as a way of thinking and solving problems.
3. To develop scientific attitudes, interests, and appreciations.
4. To develop fundamental skills and abilities.
5. To acquire personal values through science experiences.
6. To develop increasing understanding and appreciation of the environment and of one's relation to it.

The Need for Stating Our Goals in Terms of Specific Pupil Behavior

If the specific objectives set forth in the Philippine Course of Study are conceived as "directions of growth," they must be translated in terms of what they mean for the behavior of children. Objectives expressed in general terms frequently are vague, convey different meanings to different teachers, and are far removed from the practical operations either of teaching or of appraising. To be more meaningful and to provide the necessary direction, these broad objectives must be translated into more specific outcomes so that they will have common meanings to all teachers, and will be closely related to pupil behavior. They must be thought of in terms of changes produced in the learner. No factor will do more to improve the instruction of any teacher than for him to establish clearly in his own mind the purposes for his work with children. The greatest concern in teaching children is not how much knowledge or information they have acquired, important as this may be. Rather, the main emphasis should be on what kind of individuals we are developing. What kind of thinking do they do? What kind of attitudes have they developed? Are they developing good ways of thinking and working? Are they learning to be responsible? Desirable behaviors must be stated clearly and defined specifically so that they may be easily evaluated when learning is going on in the classroom The teacher must know the nature of the pupil behavior that will be displayed when the objectives have been achieved. He must evaluate the degree to which the desired changes in pupil behavior has taken place -- the degree to which the educational objectives have been attained. Although desirable behaviors may often seem to be intangible objectives, they become tangible as other kinds of objectives when specifically defined and clearly stated. Once the teacher is familiar with these behaviors and really begins to look for them, it becomes easier for him to evaluate.

Teachers then, should become thoroughly familiar with the desirable behaviors that can be developed in science teaching. When objectives are stated in these terms, the basic intent of educational evaluation can be described as the determination of the degree to which a pupil's behavior has changed so that it conforms more closely to that defined by the specific objectives. This is a complex and difficult process, and it is in this particular phase of classroom work that our teachers need special help, and also for which the major purpose of this study is geared.

As the next logical step for accomplishing the main aim of this study, clear statements of the specific objectives in terms of desirable behaviors were suggested for each unit included in the Course of Study used in Manila. The specific objectives for each science experience were determined from the content which was selected to achieve the general objectives. The content as suggested in the course was organized into the following five major areas:

Experience Area 1 - Plants and Animals

Unit I - Trees Around Us
Unit II - Our Aquatic Animals; Their Protection and Conservation
Unit III - Our Work Animals
Unit XI - Birds and Fowls
Unit XII - Air Plants
Unit XIII - Plants for Food
Unit XIV - Useful and Harmful Insects

Experience Area 2 - The Weather

Unit IV - Air and Its Importance to Life

Experience Area 3 - The Earth and Beyond

Unit VI - The Universe; Our Solar System

Experience Area 4 - Ways and Means (Practical, Mechanical, Electrical)

Unit V - Common Mechanical and Electrical Devices Used in the Home and Industry; Heat and Light

Experience Area 5 - The Human Body and Its Care

Unit VII - Safety First; First Aid
Unit VIII - The Right Kinds of Food; Their Selection and Preparation
Unit IX - Body Structure and Growth
Unit X - Communicable Diseases and Other Illnesses Affecting the Different Organs of the Body

CHAPTER III

EVALUATIVE TECHNIQUES AND PROCEDURES SUGGESTED IN THE LITERATURE AND RESEARCH

In the previous chapter, the major purposes for teaching science stated in the Philippine Course of Study were compared with those found in the literature in the United States. From this comparison, a set of general goals for the sixth grade science program in Manila was formulated. This set of goals served as a framework for developing more specific objectives for each of the 14 units suggested in the Philippine Course of Study. The specific content objectives that could be particularly developed in each unit are found in Chapter IV, while the specific behavioral objectives that could be developed in the process of teaching the units are stated and discussed in Chapter V.

To be able to suggest varied and effective techniques and procedures for assessing children's growth towards each specific content and behavioral objective, a survey of evaluative devices and methods found in related literature in the United States was made. This was done so that suitable techniques and procedures could be adopted and used in the evaluation of pupils' growth, not only in the acquisition of science knowledge but also in the development of desirable skills, abilities, habits, attitudes, interests, and appreciation. The techniques and procedures discussed in this chapter are classified into two groups -- testing procedures and non-testing procedures. The testing procedures include written tests -- informal and commercial -- and performance tests. The informal instruments consist of tests for measuring children's acquisition of science knowledge such as knowledge of terminology, specific facts, concepts, generalizations, conventions, sequences, classification, categories, criteria and structures; for measuring ability to think critically and solve problems scientifically; for determining ability to read and understand science materials and for appraising skill to observe accurately.

The non-testing procedures consist of informal techniques of evaluation such as studying children's records of activities, examining pupils' work products and listening to pupils' remarks and discussions; interviews; use of questionnaires and inventories, checklists, and rating scales and observing and recording significant pupil behavior.

Sample objective, essay, and performance tests keyed to the content of the sixth grade Philippine Course of Study were constructed to illustrate the types of tests surveyed. Samples of anecdotal records, checklists, questionnaires, inventories, and rating scales were also made to clarify the procedures selected. These samples are found in the content of this chapter.

Testing Procedures

The evaluation of changes, if any, in pupil behavior that have occurred as a result of educational experiences can be done in many ways. Ahmann and Glock (41) classify the multitude of methods into two groups: testing procedures and non-testing procedures. The testing procedures can be paper and pencil tests, oral tests or performance tests. The paper and pencil tests may be teacher made or commercial tests.

Non-testing procedures include anecdotal records, teacher-pupil interviews, checklists, questionnaires, inventories, and rating methods that summarize the results of observing samples of pupil behavior or products of that behavior. The most commonly used of these in terms of use are the paper and pencil instruments.

Objective Tests

The objective tests constitute a major portion of the paper and pencil measures. They are tests of information, of understanding, interpretation and application of concepts, principles and generalizations, of scientific thinking and methods of solving problems. They have come into widespread use for a number of reasons. Overcrowded classrooms is one of these. The objective test makes it possible for the heavily loaded teacher to evaluate certain aspects of science learnings (41). The teacher with crowded classes cannot reasonably be expected to struggle through a multitude of essay and discussion papers to do an adequate job of evaluating. Being objective, the tests can be scored with greater consistency and fairness.

Hutto (42) believes that while it is a fact that objective tests do not provide the student with an opportunity to develop skill in organizing and communicating his knowledge and the full expression of his thoughts, perhaps the most unfair criticism of the objective test is that it simply calls for a regurgitation of memorized facts by the student. This is often true, he says, but this is primarily due to the skills, or lack of it, on the part of the teacher constructing the test, not to an inherent defect in the nature of the device. The objective test can be designed to stimulate thought and analysis in arriving at conclusions. If objective tests are not used to the exclusion of other devices and techniques, and if they are keyed to the objectives to be achieved, despite their limitations, objective tests are valuable devices for the evaluation of certain objectives in science. Until that time when a feasible method of effectively using subjective tests in the overloaded teaching environment can be offered, science teachers will do well to continue to work toward the improvement and better utilization of objective tests (42).

Dunning (43), Bloom (7), and Reiner (44) also assert that objective type tests, when properly designed, will permit evaluation of students' thought processes. While it is therefore true that many of our objective tests are useful for sampling factual knowledge but are of little value in examining a pupil's ability to think, they can also be designed, if only teachers will take more time and effort, in such a way that they will permit evaluation of children's thought processes. Several sample tests are presented in this chapter illustrative of these newer type tests that have been found by the writer in the literature and reports of research.

Standardized Tests

Science objective tests may be standardized or informal. Standardized tests are constructed by teams of individuals rather than by a single person (45). They are carefully designed and are pretested in order to determine, among other things, the level of difficulty of the test items, the amount of testing time required, and the size of typical scores made by various types of pupils (45). Standardized achievement tests in science are used extensively for evaluating progress in the subject area (6). Among the standardized tests available for Grade VI classes in the United States are (46):

1. Elementary Science: Every Pupil Achievement Tests, Grades V-VIII; 1935-1966, published by the Bureau of Educational Measurements; Kansas State Teachers College, Emporia, Kansas. This is a 100-item test by Jean Stoks. Testing time is 50 minutes. The test consists of multiple-choice objective questions on basic facts and information about living things; the solar system; physical science -- sound, light, air, water, magnetism, electricity, simple chemistry, machines; conservation; health; safety, and recent developments in space exploration. There are no data on the reliability of this test as an evaluative device but norms for the tests are available.

2. Metropolitan Achievement Tests: Science Grades V and VI by Walter Durest, Harold H. Bixler, Gertrude Hildreth, Kenneth W. Lund, and J. Wayne Wrightstone. The test is published by the Harcourt Brace and World Inc., 757 Third Avenue, New York, New York, 1960.

The Metropolitan Science Test consists of 55 multiple-choice questions. Testing time is 20 minutes. The test covers the following content areas: life science (environment and growth of plants and animals, balance in nature); earth science (composition and history of the earth;astronomy; weather); physical science (sound; light; air; water; machines, atomics; chemical change; magnetism and electricity); conservation (animal, soil, water and plant) and health (nutrition and growth, body systems and processes; safety). The questions are of two kinds. Some items call for the recall of facts, generalizations, concepts and understandings. Other items require application of concepts, generalizations and understandings to life situations. Items of this kind were called problem-solving items by the publishers.

The test provides for appraisal of intellectual objectives of science education. Data on reliability and norms for the test are available.

3. Sequential Tests of Educational Progress: Science, Grades IV through VI published by the Comparative Test Division Educational Testing Service, Princeton, New Jersey.

The Sequential Tests of Educational Progress -- STEP -- have been constructed to emphasize the outcomes of an educational program in terms of developed skills rather than content. The tests attempt to measure the pupils' ability to apply basic concepts and principles of science to different situations. Each test consists of sets of multiple-choice objective questions, each set being based on a single problem situation. One set, for example, deals with the problem of selecting the best of three types of soil -- clay, sand, or loam -- in which to grow lima beans. Norms for the new forms are available.

While a great many of the test items in the standardized tests surveyed cover some of the objectives in the Grade Six Philippine Course of Study, the tests in general seem inappropriate for Grade Six classes in the Philippines. There are a considerable number of items particularly in the area of space and simple chemistry that are not included in the units suggested in the Grade Six Course Outline. In general, the vocabulary used in the test seem too advanced for Filipino children in the sixth grade. Some of the situations utilized are not within

Filipino children's experiential background. Considering the cost of the materials and the purposes for which the tests are given in the United States, it seems proper that science tests constructed in the Philippines be used in our classes instead of these.

Teacher-Made Tests

Tests constructed by classroom teachers for use in their particular classes are informal tests. According to Ahmann and Glock (45), the value of informal achievement tests stems from one major consideration — the individual nature of every class. This individuality can be traced primarily to the types of pupils who compose the class and to the kind of objectives developed in the class. The teacher certainly knows better than anyone else the exact nature of the characteristics of her class. Since the appropriateness of any achievement test item is determined by the objectives of the class, the teacher is in an excellent position to construct test items that measure suitable areas of the pupil's achievement of specific objectives and that are of suitable difficulty. Thus informal achievement tests, if properly prepared, are tailor-made for a certain class of pupils taught in a certain manner.

There are many suggestions found in the literature for preparing better classroom tests, but few seem to offer as clear guidance as the objectives in the cognitive domain as outlined in the Taxonomy of Educational Objectives (47). The hierarchical areas within the cognitive domain - knowledge, comprehension, application, analysis, synthesis, and evaluation are arranged in such a way that each successive category is built upon and dependent upon those which precede it. Successful mastery of the first category, for example, is necessary before students can demonstrate competence in the second.

Tests for the Acquisition of Knowledge

The knowledge category is well known to our teachers. It emphasizes the process of remembering and the acquisition of factual information. This includes knowledge of terminology, specific facts, conventions, trends and sequences, classification and categories, criteria, methodology, principles, generalizations and knowledge of theories and structures. Below are sample test items based on the Philippine Course of Study illustrating the knowledge category.

I. Tests devised by Bloom (47)

A. Knowledge of Specifics
   1. Knowledge of terminology
      Example: An aquatic animal lives in the (a) air (b) caves (c) land (d) water

   2. Knowledge of specific facts
      Example: The National Tree of the Philippines is the (a) acacia (b) mango (c) molave (d) narra

B. Knowledge of Ways and Means of Dealing with Specifics
   1. Knowledge of conventions
      Example: Magnetic poles are called (a) negative and positive (b) north and south (c) plus and minus (d) electron and proton

   2. Knowledge of trends and sequences
      Example: A butterfly goes through four stages as it grows.
      (a) 1) egg 2) larvae 3) pupa 4) adult
      (b) 1) egg 2) pupa 3) larvae 4) adult
      (c) 1) larvae 2) egg 3) pupa 4) adult
      (d) 1) pupa 2) egg 3) larvae 4) adult

   3. Knowledge of classification and categories
      Example: Which of the following is an amphibian?
      (a) oyster (b) milkfish (c) crab (d) frog

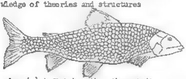
   4. Knowledge of criteria
      Example: Maria wanted to buy some fish for lunch. Which of the following descriptions will help her select fresh fish?

(a) limp body; silvery scales
(b) firm body; red gills
(c) limp body; reddish eyes
(d) reddish eyes; brownish gills

5. Knowledge of methodology
Example: There are different ways of catching fish. Which of the following are good to use? Check your answers.
(a) salambao (dip nets)
(b) hook and line
(c) dynamite
(d) salacab (trap made of bamboo)

C. Knowledge of the Universals and Abstractions in a Field
1. Knowledge of principles and generalizations
Example: Lito placed a dragonfly in a small glass jar. He covered the jar tightly so that the dragonfly could not escape. After several hours the insect died. Why?
(a) air occupies space
(b) living things need air in order to live
(c) living things need light in order to live
(d) air exerts pressure

2. Knowledge of theories and structures



Example: (a) A fish breathes through the __________. Show by an arrow (↗) where this part of the fish is found.
(b) Check which part helps the fish to push up and down.

II. Tests designed by Packer - Packer (48) thinks that most teacher-made tests and standardized examinations in science fail to provide much evidence of growth in achievement of objectives in understanding. She suggests that if teachers want to sample understanding of science rather than factual information, it would be best to devise objective test items for use with intermediate children. The following illustrations make use of Packer's suggestion and are based on the Sixth Grade Course of Study. Notice that the item asks first for a factual answer, then for a big idea.

> Example: The people living on a certain mountainside cut down trees for lumber to be sold to a neighboring province. Soon all the trees on the mountainside were gone. What would probably happen? Circle only one.
> (a) The soil became rich and fertile
> (b) The area was soon covered with trees
> (c) Much soil was washed away by the rains
> (d) Wildlife became more abundant
>
> Which of the following big ideas of science gives the best explanation of what you think happened?
> (a) Trees prevent floods
> (b) Trees use up the soil
> (c) Animals like to live in clear areas
> (d) It does not take long to grow trees
> (e) Trees help prevent soil erosion.

III. Tests designed by Matthews - Matthews (49) evaluated third grade children's understanding of some science terms and concepts by giving tests in the form of games. More than one approach to each concept was made. This was done by using pictures and questions and encouraging each of the twenty children taking the tests to talk freely so that the examiner could gain some insight to the child's understanding of the terms and concepts presented.

A similar technique that is projective in nature was suggested by Navarra (50). Series of pictures were developed and used as devices for gathering basic information from the children. The use of pictures was based on the idea that a child projects his experience. Information was gathered as to the types of organization the child suggested for the pictures as well as the types of clues he used.

Examples of questions that were asked to draw the desired responses from the children were: "What is this picture about?" "What do you think is happening?" "Do you think this picture is right?"

The author believes that while there is much more to the development of this technique, it will help teachers gain an insight into the kinds of responses children are capable of giving.

IV. Tests reported by Boener - Several picture tests for measuring children's comprehension of science concepts were reported by Boener (51). In these tests the children react to the problem situation by grouping or selecting procedures based on similarities or differences in the objects pictured. The first of these tests was the non-verbal test developed by Haney (52). This is a picture test in which the pictures of four animals having a common characteristic are compared with four other pictures of different animals one of which has the characteristic common to the first four animals.

Another use of pictured problem situation described by Boener (51) was two bulletin board posters each entitled, "Science Picture Quiz." These quizzes prepared by Herman and Nina Schneider were produced for distribution by D. C. Heath and Company. The posters presented a series of problems showing some manipulation of science materials and asked the children to predict, "What Happens?" Boener thinks that like Haney's tests, the "Science Picture Quiz" seemed to be difficult for early elementary children in the United States.

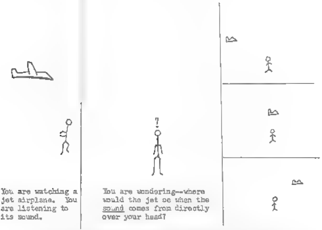
To simplify the picture "reading" skills needed by the children a series of tests were developed with the following format:

1. stick figures were used for the drawings of people: no color was used.
2. the symbol "?" was used to indicate the existence of a question.

3. only objects familiar to the children were pictured.

The test questions were designed so that only one test question appeared on each page. The page was divided vertically into three parts. "Box 1," the left box, pictured the objects or situations to consider. "Box 2," the middle box, pictured a problem situation or a stick figure with a "?" over his head. This box presented the question. "Box 3," the right box, was divided horizontally into three equally smaller boxes for the three alternative answers to the question.

Example (51):



You are watching a jet airplane. You are listening to its sound.

You are wondering--where would the jet be when the sound comes from directly over your head?

In administering the test, the teacher orally identified the objects or situation pictured in Box 1 and then read the question raised by Box 2. Each child responded to the question by circling the answer in Box 3 which he thought best answered the question.

V. Tests devised by Nelson - Another instrument was developed by Nelson (1) to investigate the level of children's understanding of certain concepts and principles of light and sound. This was a multiple-choice word classification test consisting of 77 words. In these Object-Classification tests the child was asked to make pairs of the science models and then tell the investigator why he placed the particular items together.

Example:

In the Area of Light	In the Area of Sound
Camera and eye model	Horn and reed
Spectacles and hand lens	A tuning fork and a bell
Prism and paint set	Ear muffs and insulation
Microscope and telescope	Toy telephone and stethoscope
Translucent light bulb and waxed paper	Violin bow and carpenter's file

The child was given a score of two for a perfect response for his classification and a score of one if he evidenced some idea or partial concept for the classification.

Tests for Critical or Scientific Thinking

Tests for measuring the ability to think critically and to solve problems scientifically found in the literature indicate attempts to redirect the evaluation of science teaching towards thought processes. Bloom (47), Dunning (43), Dressel (53), Lombard (54), and others devised objective examinations to evaluate growth of students toward these more complex objectives. Below are examples of test items keyed to the content of the Grade VI Course of Study which are designed to measure the ability to think and solve problems scientifically.

I. Tests designed by Bloom (42)

A. Comprehension

1. Translation from one level of abstraction to another
   Example: The principle of air pressure is illustrated by
   - (a) the cooling effect of moving air
   - (b) drinking through a straw
   - (c) the burning of a candle
   - (d) the drying of wet clothes

2. Interpretation
   Example: All the energy that enables you to live and grow comes from plants. You get some of it by eating plants. You get the rest by eating food from animals that ate plants. The source of human energy is in a plant.

   On the blank spaces before each number write A if the facts given in the paragraph definitely show that the item correctly completes the beginning statement, B if the facts given in the paragraph do not definitely show that the item correctly completes the beginning statement.

   Your body would not have energy

   ____ (a) if there were no plants

   ____ (b) if you did not eat food from animals

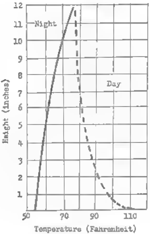
   ____ (c) if you did not eat plants

3. Extrapolation

   Extrapolation is making inferences from trends or relationships in data and requires a recognition that the inference involves some degree of probability. Extrapolation involves generalizing from one situation to similar situations, from a trend in the past to a prediction for the future.

Example: Day and night air temperatures vary (28).

This item is a test on both interpretation and extrapolation. Items b, c, d, and f test for the ability to extrapolate.



The graph above shows the records some scientists made of temperature at ground level and at every inch above ground for 12 inches. They made their measurements during a sunny day and also at night.

After the number on the answer sheet corresponding to that of each statement, write

- A - if the information given in the chart is sufficient for you to think that the statement is definitely true.
- B - if the information given in the chart is sufficient only to indicate that the statement is probably true.

C - if the information given in the chart is not sufficient to indicate any truth or falsity in the statement
D - if the information given in the chart is sufficient for you to think that the statement is probably false.
E - if the information given in the chart is sufficient for you to think that the statement is definitely false.

___(a) During the day the air nearest the ground is cooler than the air 12 inches above the ground.
___(b) The records of the day temperature shown in the graph must have been taken during a sunny day in summer.
___(c) The differences in temperature of the air at different levels must be due to the heat coming from the ground.
___(d) The ground affects the temperature of the air above it.
___(e) At night the temperature of the air five inches above the ground is cooler than the temperature of the air ten inches above the ground.
___(f) The temperature of the air during the day was taken at different hours of the day.

B. Application

Example: On a hot afternoon Linda placed three ice cubes in a glass and filled it three-fourths full with orange juice. In a few minutes she saw water on the outside of the glass. Where did the water on the outside of the glass come from?

Direction: Choose the conclusion which you think is most consistent with the facts given above and most reasonable in the light of whatever knowledge you may have. Put a circle around the letter indicating your answer.

(a) From the orange juice inside the glass.
(b) From the air around the glass.
(c) From the melting ice inside the glass.
(d) It's some kind of magic and cannot be explained.

Direction: Choose the reason you would use to explain or support your conclusion by putting a check before the letter of the correct answer.

Reason:

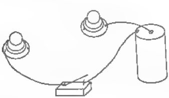
(a) When liquids get cold they can penetrate through glass.
(b) Orange juice tends to separate from ice water.
(c) The warm air around the glass absorbs some of the cold liquid inside.
(d) As the glass cools, it contracts and gives off some of the liquid inside

(e) When warm air is cooled, it can no longer hold as much moisture as when it was warm. The moisture is deposited on the surface of the glass.

(f) There are things that happen which we can never understand.

C. Analysis

Example: Study of Circuits



Study the illustration given above. Then answer the following questions.

(a) Will the lamps be lighted? If your answer is yes, write the word yes. if not, show on the illustration what you will do to make them burn.

(b) Trace the path of the current by drawing arrows.

(c) The lamps are connected in what kind of circuit?

D. Synthesis

Production of a unique communication

Write a composition on any of the following topics:

(a) The Importance of Trees

(b) If There Were no Trees

(c) How We Can Protect Our Trees

E. Evaluation

Example: You have 15 cents to spend at recess. You found the following foods sold at the lunch counter. What will you buy?

Sandwich - 10¢
Calamansi juice - 5¢
Milk - 10¢
Coca-cola - 15¢
Turnip - 5¢
Green mango with bagoong - 5¢
Cookies - 5¢
Cake - 15¢
Fried camote - 5¢
Soup - 10¢
Boiled peanuts - 5¢
Orange - 5¢
Chewing gum - 10¢

Give some reasons for your choices.

II. Tests designed by Dunning - Dunning (43) devised objective examinations to evaluate certain aspects of critical thinking. The tests were designed to measure (1) ability to apply principles, (2) ability to interpret data, and (3) abilities associated with the nature of proof.

In Dunnings' tests the term "principles" is used in a broad sense. It covers any science fact, generalization, or understanding as well as allowing the use of acceptable analogies and authoritative sources to justify one's conclusions. Each test item is given in the form of a problem situation. Considering the facts given in the problem, the student is given the task of offering a solution to the problem or of formulating and supporting a conclusion. Unlike other tests of this type, the student is first given an opportunity to think through the problem by answering a series of questions before he is asked to form a conclusion.

Example: Nora wanted something to drink. She got a can of pineapple juice and with the help of a can opener punched a hole in the top of the can. She turned the can on its side and tried to pour the juice into her glass. No juice would come out. "What could be wrong? she thought.

If you were to help Nora with her problem, what will you do? To help you decide what to do, answer the following questions below.

Directions On the line after each question write the correct answer.

(a) Is air needed to help liquid flow out of a container? ________
(b) How many holes or openings are needed? ________
(c) Will air entering the can exert pressure on the liquid? ________
(d) How will you turn the can in pouring out the liquid? ________

Based on your answers above, what will you do if you were Nora? Write your answer.

III. Tests devised by Bradfield and Moredock - Bradfield and Moredock (55) suggest the following types of tests for measuring the ability to think scientifically.

Illustration 1 - Determining if a statement can be verified scientifically.

Directions: For each of the statements listed below, write:

A - if the statement can be scientifically verified
B - if the statement is an accepted theory and hence need need not be scientifically verified
C - if the statement contains a value judgment and hence cannot be scientifically verified
D - if the statement is a definition and needs no further verification

______ (a) Work is done when force is exerted through a distance.
______ (b) Shade trees are more needed along public highways than ornamental plants.
______ (c) Plants need air in order to live.
______ (d) The earth is spherical in shape.
______ (e) The bending of light as it passes obliquely from one media to another is known as refraction.

Illustration 2 - Ability to perceive relationships in scientific data and to perceive the limitations of scientific data.

Example: A survey of the causes of illnesses among Grade VI children was made in an elementary school. The following results were reported.

Kinds of Illnesses	Percentage of Children Who Were Sick
Common cold	36
Toothache	11
Headache	9
Flu	8
Accidents	14
Measles	3
Chicken pox	3
Intestinal disorder	6
Sore eyes	2
Other causes	8

Directions. Below are some statements that are interpretations of the above data. For each statement, write:

T - if the statement is a reasonable interpretation of the above data
U - if there is insufficient evidence supporting the statement
F - if the above data contradict the statement

A. Reading points
  1. Most of the children who got sick were injured.
  2. Eleven percent are not brushing their teeth.

B. Comparison of reading points
  1. More children had measles than chicken pox.
  2. Less children had toothaches than other illnesses.

C. Cause
  1. Most accidents are the results of carelessness.
  2. Lack of sleep is one cause of headache.

D. Effect
  If children were more careful with the foods they eat, there would be less intestinal disorders.

E. Value judgment
  Children need more lessons on the causes and prevention of common colds.

IV. Tests designed by Dressel - Tests for measuring scientific thinking as evidenced by the ability to (1) locate and define problems, (2) recognize hypotheses and select methods of testing them, (3) critically evaluate experimental procedures, data, conclusions, and implications, and (4) appraise real situations were devised by Dressel (53).

An illustration of these tests is presented below. This item is based also on the Sixth Grade Course of Study.

Example: 1. A Grade VI class at the Rizal Elementary School was interested in plants and trees. 2. Mr. Mendoza, the principal, gave the children a part of the school garden to study plant life. 3. The children wanted to know the effect fertilizer has on green plants. 4. Someone suggested that they read a book about plants. 5. Another proposed that they consult the garden teacher or try experimenting with plants. 6. The class decided to do the experiment. 7. They put some soil from the school garden in two boxes. 8. To the first box they added natural fertilizer (horse manure). 9. To the second box they added some chemical fertilizer. 10. In each box they planted ten patani (bean) seeds. 11. In a few days the seeds began to grow. 12. The children watered each box with the same amount of water.

A. Ability to recognize a problem
Which of the sentences in the paragraph constitute a problem? (Something that the children wanted to know). Write the number of the sentence.

B. Ability to recognize hypotheses and select methods of testing them.
1. Which sentences tell the solutions suggested to solve the problem? Write the number of the sentence.
2. Which sentence tells what the children did to solve their problem? Write the number of the sentences.
3. Which of the following will best tell the children's reason for doing the experiment? Write the letter of the statement.
   (a) Doing an experiment is fun.
   (b) Doing some experiments will make them scientists in the future.
   (c) The experiment will help them know the effect of fertilizer on the growth of green plants.
   (d) The experiment will help soil drainage.

C. Ability to critically evaluate experimental procedures, data, conclusions, and implications.
1. What is missing in the experiment? (Something which the children failed to do). Write the letter of the correct answer.
   (a) A box of soil with both natural and chemical fertilizer planted with ten patani seeds.
   (b) A box of soil without patani seeds.
   (c) A box of soil without fertilizer planted with ten patani seeds.

(d) A box of soil planted with different kinds of seeds.

2. Which of the following will help the children make a good conclusion? Write the letter of the statement.
   (a) The color of the soil.
   (b) The nature of the plants growing in each box.
   (c) The amount of water needed to keep the soil moist.
   (d) The amount of sunshine needed by the plants.
3. Which of the following may the children do to verify their conclusion. Write the letter of your answers.
   (a) Read books about green plants.
   (b) Collect different kinds of seeds.
   (c) Repeat the experiment.
   (d) Consult the guidance teacher.

D. Ability to appraise real situations.

Appraisal of real situations requires a knowledge and understanding of pertinent fundamentals, as well as the ability to apply this knowledge correctly. The following items are intended to measure the ability to make such applications of principles to real situations.

Example. Mang Berto, the school gardener, transferred some banana plants to another part of the school yard. He pruned the leaves before digging out the plants. Why did he do this?
1. To reduce the bulk of the banana plants.
2. To give the plants a better appearance.
3. To reduce transpiration.
4. To help the plants get more minerals from the soil.

V. Tests Designed by Tyler - Tyler (56) analyzed the ability to solve problems scientifically in terms of three specific pupil behaviors: (1) the ability to formulate a reasonable generalization from specific experimental data, (2) the ability to plan an experiment which can be used to determine whether or not a proposed hypothesis is true, (3) the ability to apply general principles to concrete situations. He constructed tests which require students to do the following:

A. Formulate a reasonable generalization

Example: Pepito got three large jars of equal size. He filled the first one with stones, the second one with water,

> and the last one with soil. He placed them side by side in a place where they can get enough sunlight. Then he planted six bean seedlings in each jar and watered them each day. After several weeks the seedlings in the containers with water and stones died. Those in the container with soil grew. Why?

B. Plan an experiment which can be used to determine whether or not a proposed hypothesis is true.
   Plan an experiment to show that plants produce and store starch.

C. Apply principles to new situations
   After a heavy rain, the school garden was under water for two days. Several trees and plants died. Why?

VI. Other tests - Other tests which were developed for measuring children's ability to comprehend science materials and think critically were the tests developed by:

1. Nelson and Mason (57) for upper elementary grades. In these tests, the children were given story situations and were asked to answer some questions calling for the ability to (a) interpret data given, (b) understand and apply principles, (c) draw and support conclusions, and (d) identify whether a given statement is a fact, observation, problem or hypothesis.

The instruments were similar to those of Blooms' (47) second, third and fourth categories and to the tests constructed by Dressel (53).

2. Theodore Munch (58) for evaluating the ability to interpret data from experiments, charts, and graphs. These tests were also similar to the Bloom (47) and Dressel (53) instruments.

3. Bradfield and Moredock (55) and Smith and Tyler (59) for testing the students' ability to formulate an experiment. An example of this type of test is:

> How would you find out which of these two magnets is the stronger? Describe what you will do.

4. Colhurst (60) to appraise children's "doing skills." The tests were of two types -- free response test and limited response test. In both tests the student was given the task of (a) studying a given figure carefully and to list all the items which would be necessary to describe it to someone in a way he would recognize it, (b) compare two figures as to their similarities and differences, (c) determine the relative importance of each of a set of given facts by placing them in the order of importance, and (d) choose the correct items concerning a given statement.

Examples:

(Picture of a cow) (Picture of a carabao)

Figure 1. Figure 2.

(a) Study Figure 1 and list all that is necessary to describe it to your friend. Make your description so complete that your friend would recognize easily what you are describing.

(b) Compare Figure 1 and Figure 2.
    (1) List all the ways in which they are alike.
    (2) List all the ways in which they are different.

(c) Select the items which are necessary to make the statement complete. Number them in the order of importance. Leave out any incorrect items.

Plants and trees are important to men because

____ they beautify our surroundings.
____ they give us materials to build our houses.
____ they give us shade.
____ they make the winds.
____ they give us food.
____ they give us materials for making furniture.
____ they bring us good luck.

(d) Choose the correct items concerning the following statement.

Plants and animals are alike because they need

(1) water
(2) air
(3) carbon dioxide
(4) sunlight
(5) shelter

Tests for Measuring Children s Understanding of Causes and Effect Relationships

I Tests reported by Reiner - Several devices have been reported by Reiner (61) that test children's understanding of causes and effect relationships. Among them were the "Causes and Effect Relationship Test in Science" and "A test for Understanding of the Scientific Method," which was to a great extent a measurement of understanding of causal relationships, published by the Wisconsin Educational Association in 1935. The first contained sixty-six items, each composed of coupled phrases. The first phrase of each couplet is presumably a cause of the phrase that follows. For example, "Heat is applied to water, the water boils. The respondent was asked to choose which one of the four following relationships exists between the parts of the couplet.

(a) The first is practically the sole cause of the second.
(b) The first is one of a number of important contributing causes of the second.
(c) The first contributes only slightly to the second
(d) The first bears no causal relationship to the second.

In the second test, the respondent was asked to identify the factors which contributed to the results or effects of an experiment. An example was the problem which dealt with "Factors Which Affect the Pitch of a Vibrating String." The factors presented were (a) length of wire, (b) tensions, (c) weight of wire per unit length. Different conditions were described and the respondent was asked to encircle the factor or factors which contribute to the effect or result.

Another type of test reported by Reiner (61) was the "Probable Causes of Events Tests" constructed by working committees for the Progressive Education Association. In these tests a series of problems in story form was presented and the respondent was asked to write after each "happening" the probable cause.

A different technique was used by Howard and Robertson (62). The authors constructed an objective scale of thirty-one items for measuring the attitude "conviction of cause and effect relations." Each item stated a causal relationship which the respondent was required to accept or reject.

Reiner (63) developed a test to measure "ability to recognize three different degrees of cause and effect relationships." Each item consisted of a description of a pair of physical events. The sentences describing these events were separated from each other by a typographic -- // -- mark. For example, "A cow eats grass // The cow gives milk." The respondent was asked to state whether the condition described in the first sentence of the above pair was a direct cause, indirect cause, or no cause of the second, by encircling one of the letters -- D, I, N -- written at the left of the number of each question.

Other forms suggested by Reiner (63) which may be tried are:

1. The respondents may observe actual situations in a laboratory, lecture, or real life experience instead of only reading about them on examination papers.

2. Motion pictures, film strips, slides or still pictures may be employed to present causes and effects from which respondents may be asked to draw relationships.

3. Present data in the form of graphs, tables, and flow sheets and ask children to find the causal relationships.

An experimental technique of analyzing cause and effect relationships was also suggested by Reiner (64). The sample given below was done in conjunction with a lecture-demonstration that was designed to answer the problem, "How does heat affect the size of solids?"

In performing such analysis, three columns labeled Effect, Cause, and Evidence were written on the blackboard. After the demonstration had been completed the teacher then stimulated, guided, and directed the pupils' thinking toward the goal of completing the analyses according to the general pattern indicated below:

> Effect: The heated ball would not pass through the ring.
> Cause: Ball increased in size. Heat caused the expansion.
> Evidence. Before heating, the ball was able to pass through the ring. After heating, the ring was found to be unchanged.

As an evaluative device, the pupils can write their reports of the demonstration in their notebooks. Under the "effect" column will be the report of the observation of the single physical phenomenon of the demonstration. The teachers should select for analysis those phenomena which they think the pupils will find most interesting and exciting.

In the "cause" column will be written the pupil's opinion of the cause of the selected phenomenon. It may be one or more connected but dependent causes. Whenever this is the case, the causes should be listed separately and in the order of their immediacy as shown in the example above. However, no distinction is to be made as to whether one of those was a direct or an indirect cause. Another practice which may be followed in completing the cause column is to limit the responses only to those which are verifiable by direct observation. Although the initiative of selecting the effect to be studied should be left mainly in the hands of the teacher, the burden of proof of the cause must be put chiefly upon the pupils.

In the "evidence" column should be written the justification for believing the cause to be correct. Most of the evidence to be cited would be sensory in nature, such as observed changes in size, color, or weight.

II. Bradfield and Moredock - Bradfield and Moredock (59) consider the ability to identify cause and effect relationships as one of the aspects of critical thinking. They proposed the following test to measure the ability.

> Directions: Below are listed pairs of events. In the blank space between the two events, write:
>
> - A - if the first event is the cause or contributing cause of the second event
> - B - if the first event is the effect or result of the second event
> - C - if there is no cause and effect relationship

First Event		Second Event
Clouds are moving in the sky.	____	Heavy dust is in the air.
A weight is placed on the end of a suspended spring.	____	The spring stretches.
Johnny's eyes water.	____	Johnny's feet sweat.
Walking under a ladder.	____	Getting hit on the head with a paint bucket.
The sound from a drum.	____	The beating of a drum.

Tests for Evaluating the Ability to Observe Accurately

Munch (58) attempted to show how written responses may be used as a source of evidence to evaluate children's ability to observe and record observations accurately. He suggested the following techniques.

1. Arrange six or eight articles on a table or desk. Ask the students to study the display for one minute. Cover the display and then ask each member of the class to describe in writing as much detail as possible as many articles as he can. Repeat the test throughout the semester, increasing the number of items displayed.

2. Provide the following or similar activities to develop a sense of alertness and a feeling that close attention must be given to demonstrations or other situations.

Before the demonstration give the class the following oral instruction: A person is said to be observant when he is conscious of what is happening about him or what goes on in situations which he meets. Today we want to study your ability to see what goes on in a situation. I will perform an easy demonstration. When I have completed the demonstration you will be given an opportunity to write down the different things which I did and which took place during the demonstration.

Without further comment, start on the demonstration stated below.

Example: To show that air exerts pressure (20).

> Put some water in a teakettle, being careful not to fill it above the spout. When steam is coming from the teakettle spout, invert a milk bottle over the spout. Leave it for about a minute. Hold the bottle with a towel and remove it from the spout, lowering it quickly, mouth down, into a pan of water. As the hot air in the bottle cools, the water will rise in the bottle.

After the demonstration ask the children to answer the following questions in writing.

(a) How much water was put in the teakettle?

(1) Enough to fill the teakettle to the brim.
(2) Just enough to fill it above the spout.
(3) Just enough to fill it below the spout.
(4) About a cup full of water.

(b) When was the bottle placed over the spout?

(1) After filling the kettle with water.
(2) Before the water began to boil.
(3) When steam began to come out from the kettle.
(4) After the water cooled off.

(c) After inverting the bottle over the spout, what did the teacher do?

(1) Poured some water into the teakettle.
(2) Removed the bottle immediately from the spout.
(3) Allowed the bottle to stay over the spout for about one minute.
(4) Allowed the bottle to cool.

(d) As the bottle cools

(1) The level of water in the pan rose.
(2) The level of water in the pan fell.
(3) The level of water in the pan remained the same.
(4) The water in the pan evaporated.

Essay Tests

Written methods of evaluation include not only objective but also essay tests. Several books (65) in science education have suggested the use of essay tests in the upper elementary grades. Victor (22) has pointed out the following advantages of the essay tests as evaluative instruments in science. Essay questions can be constructed readily. They can be used to measure how well children can analyze problems, think critically, recall and interpret previous knowledge, organize and present ideas, and arrive at conclusions. The pupils' responses to an essay examination can also help the teacher gain some insight into the pupils' interests, attitudes, and appreciations (66). Essay questions can be stated so that they provide evidence of retention of facts, acquisition of concepts and of behavior depending upon the objectives to be evaluated. Monroe and Carter (67) have listed several types of essay questions. The types which seem suitable for Grade VI classes are given below with an illustration of each type drawn from the content of the Philippine Course of Study.

A. Selective recall-basis given
What is the importance of aquatic animals?

B. Evaluative recall-basis given
What do you consider the three most important uses of trees?

C. Comparison of two things
Compare mollusks with arthropods as to characteristics and usefulness to man.

D. Causes and effects
Why is the government prohibiting the use of dynamite in fishing?

E. Explanation of the use or exact meaning of some terms or phrase
Describe the process of photosynthesis.

F. Analysis
What special adaptations of amphibians enable them to live both on land and in water?

G. Statement of relationship
Why are water plants important in an aquarium?

H. Illustration or examples of principles
Explain how some household appliances make use of air.

I. Classification
How will you classify trees according to use?

J. Application of rules or principles
If you were transplanting a young plant from one side of the yard to another, what would you remember to do? Why?

K. Discussion
Discuss how plants make food.

L. Outline
Outline the steps in making paper out of wood pulp.

M. Criticism
What is wrong with this menu?

Boiled rice
Fried chicken
Fried potatoes
Ice cream
Cake

Essay questions have definite disadvantages as well (66). They do not allow for adequate sampling because only a few questions can be asked at one time. They take much effort and time to correct. They are often worded in vague and ambiguous ways. They are often scored in a highly subjective manner.

Victor (22) offers several suggestions to eliminate these disadvantages. He believes that the best arrangement would be a combination of objective and essay questions with approximately one essay question offered per test. He suggests that questions should be worded carefully so that they are clear and specific. Many teachers tend to give broad topics which children find difficult to develop. A typical example is "Communicable Diseases and Their Prevention."

Such a topic gives children no direction. At the elementary school level, the children are not particularly adept at organizing and presenting their thoughts and understandings. With such a broad topic, children are likely to turn in a wide variety of responses. Some responses will be short and inadequate. Others will be rambling, lengthy but full of unnecessary details. These kinds of responses make the correction and scoring of essay tests difficult.

To minimize this difficulty, the children must be given some form of direction. One way recommended by Victor (22) is for the teacher to divide the essay question into a number of parts. Each part should be worded clearly and carefully, asking for specific information pertaining to the major concepts called for in the essay question. Using the same example based on the Sixth Grade Course of Study given above, the question may be framed as follows:

> There are many ways of preventing the spread of communicable diseases.
>
> a. What are communicable diseases? Give some common examples.
> b. How is each spread?
> c. What can we do to prevent the spread of communicable diseases?

These guide questions will make it easier for children to write on the topics given. They know exactly what the teacher wants yet no clues nor answers are given, only directions. Guided by the questions the children will be able to organize and present their ideas in logical sequence. They will also help the teacher in scoring the answers, making the grading of the papers less subjective.

Non-Testing Procedures

The Use of Observational Techniques

Observation of behavior plays a vital role in the evaluation of children's growth towards the objectives of science education (19). It is a valuable method of evaluation because it yields evidence of the integrated functioning of the child and can be employed in evaluating a wide range of outcomes, many of which cannot be measured objectively (10).

The technique does not disturb normal activity and therefore gives far more reliable results than data taken under such artificial conditions as interviews, paper and pencil tests, or other performance tests (66). A class, for instance, may continue classroom work or play activities uninterrupted by an observer.

The types of situations for which observations are made may be free or natural situations, manipulated situations, or partially controlled situations.

There are two major methods available for observing and recording observations. In one, the specific behavior to be observed are selected and defined in advance and a record is made of those activities only which fit the defined categories. In the other an account of observations is made without the help of predefined categories.

The method of recording observations may use special techniques or tools such as specially prepared charts or checklists, rating scales or descriptive records (66). Regardless of which technique is used, in all cases, the teacher should keep a permanent dated record of each child's growth in behavior. The records may be of any behavior or they may be of behavior directly related to the objective of a particular learning experience. These records should be consulted periodically to give the teacher some indication of how well the children are progressing and what can be done to help them (66).

Anecdotal Records

Anecdotal records are short statements describing what a child said or did in a specific situation. The statements should be recorded as soon as possible after the observation was made. To be valid, anecdotal records should be kept for each child over a long period of time to furnish sufficient pertinent information about the child's growth in desirable behavior (22). Acquiring these anecdotes of behavior takes time but the information they yield is important.

The minimum standards for recording anecdotal records includes: date of each entry, statement of situation in which incident occurred, a factual description of the incident, objective reporting of any related information, and an adequate number of sequence of anecdotal records upon which to base a judgment (66).

In order to keep the task of observing and recording from becoming too burdensome, Wrightstone (66) suggests that the observation should be restricted to three or four important behavior characteristics and when possible to only a few pupils. The method of recording should be as simple as possible.

Below are examples of two forms that may be used in recording observations. The first form is suggested by Wrightstone (66) while the second one is similar to the form suggested by Carin and Sund (17).

Example: An anecdotal record of children's growth towards scientific thinking.

P.C. Stated the problem clearly for the group.
J.V. Suggested experimenting with three kinds of soil.
D.M. Planted corn grains without much help. Spaced them evenly. Accurate in measuring water used.
M.T. Observed plants regularly. Accurate in measuring heights. Kept accurate records of observation.
C.L. Stated a valid conclusion. Proposed checking results of experiment.
R.M. Suggested repeating the experiment.
J.N. Suggested checking results against information found in Social Studies text.

Example: Record of growth towards the ability to observe carefully and record observations accurately.

No.	Mos. J F M A M J J A S O [✓ N] D
Child's Name: Ben Lopez	Das. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 [✓ 27] 28 29 30 31
Behavior Objective: Ability to observe carefully and record observations carefully.	
Noted differences in: (Indicate with a check). ✓1. size of trees 2. type and growth of stems and branches ✓3. type and texture of barks ✓4. shape, color, size, amount of leaves ✓5. flowers - color, scent, size, growth (single, clusters, etc.) ✓6. fruit - color, shape, size, growth (pods, clusters, etc.) 7. other characteristics - folds leaves at night, sheds leaves, etc.	Continued observing long after the others had stopped. Noted differences not only in size and shape of leaves but also in edges and texture. Recorded observations accurately.

This anecdotal record indicates that the teacher observed and recorded the behavior of Ben Lopez on November 27. At a glance the teacher will readily know that the record pertains to accuracy of observation and recording. The behaviors that were checked were noted and observed. Other evidences of desirable behavior not in the list were jotted down.

As these records accumulate the teacher can begin to see the direction of growth in behavior and attitude. With a minimum of work each day, the teacher can move from guesswork to more accurate observation and record keeping. It is unsatisfactory for a teacher to merely say that a pupil has developed the ability to observe accurately. She must have some records to substantiate her claims.

The same form with different behaviors can be duplicated and used for evaluating other specific objectives of the science program.

The Use of Anecdotal Records and Other Non-Testing Procedures for Evaluating Attitudes, Habits, Interests, and Appreciations

A good evaluation program indicates adequately not only the degree to which children are acquiring knowledge, skills, and abilities, but also the extent to which they are developing desirable attitudes, interests, habits, and appreciations. The teacher is not only concerned that a student be able to do a task when he needs to, but more important is that he does do it after he has learned that he can do it. Although in general schools reward students more on a can do than on a does do basis, it is the latter which every teacher must seek (68).

Attitudes, habits, interests, and appreciations may take several years to develop to a significant degree and since a teacher rarely has the same pupils over a sufficient period of time, an evaluation plan covering at least several grades and involving the coordinated efforts of several teachers becomes a necessity. Anecdotal records, checklists, rating scales and other non-testing devices are especially useful in the evaluation of these objectives. The following are examples of anecdotal records indicating children's growth towards the development of desirable attitudes and interests. The form suggested by the Forty-Fifth Yearbook of the National Society for the Study of Education, The Measurement of Understanding, was adopted (69).

Example 1:

Date	Place	Comments
July 13, 1966	Classroom	Jose: I made a bird feeder yesterday. I hope many birds will come to it.

Example 2:

Date	Place	Comments
August 2, 1966	Classroom	Paolo. I've never seen fishes with light organs, but I suppose there might be some
August 2, 1966	Lunch counter	Ofelia bought a banana and some peanuts instead of her regular cake.

Recording remarks verbatim - Victor (22) believes that this method is better than the technique of using anecdotal records because it tells precisely what the children said. There is one drawback though -- it is difficult for the teacher to write down remarks verbatim while discussion is going on, and it is time-consuming as well. Some teachers tried to solve the problem by using tape recordings during class discussion periods. Taken at periodic intervals, accounts can then be analyzed after class or at the teacher's leisure. The tape recorded sessions have some important advantages over the written records of the teacher's observation (17). "Greater objectivity is possible by using the tape recordings and greater substantiation is possible through unlimited playback of the tapes. There is also great value in using these tapes directly with children as feed back and learning experiences in which they can be encouraged to use the recordings as self-evaluation (17,p.147)."

Recording observations by "codes" - West (70) and Hill (71) used a method of recording observations known as the "coding" technique. The procedure is as follows. First the teaching goals are determined. Then a code number is assigned to each goal. As a child exhibits a certain kind of behavior, the code number which most nearly fits that kind of behavior is entered on a data sheet opposite that child's name. Data of this type are gathered for several consecutive days and at a later date for several more consecutive days. The total number of entries for a given pupil is regarded as his score.

The log - The log is a convenient method of recording daily happenings in school. In using this technique, all that the teacher has to do is to note the date and a quick summary of the attitude expressed by a pupil during that day (66). Below are examples of entries in a teacher's log book.

> September 18 - Teresa threw away an earthworm with the help of the hand shovel she was using. She said she didn't like the sight of them and she's glad the birds eat them.
>
> September 20 - In her report about the use of fertilizers, Teresa reported about the work of earthworms. She remarked she didn't know they could be that helpful.

Checklists

A faster but perhaps less comprehensive way of assessing growth towards certain science objectives is through the use of checklists and rating scales (17). The checklist may be defined as a prepared list of items that may relate to a person, procedure or object (66). The teacher, for instance, may make a list of desirable behaviors involved in an activity and then show by check marks whether or not the behaviors were manifested by the children. Sometimes the date when the behavior was manifested is entered instead of simply putting a check. As the teacher does this at regular intervals for a period of two or three weeks, she can get a picture of the nature of the actions or contributions of the children in her class. The following are examples of checklists which may be used in science classes.

Example 1. The following checklist which is to be completed by the pupil includes items which indicate the use of multiple resources in finding out important information about the uses and care of trees.

Directions: Check only the steps you have taken.

_____ Read the textbook
_____ Consulted one reference book
_____ Consulted two references
_____ Consulted three or more references
_____ Read other resource materials such as pamphlets, brochures, magazine articles, etc.
_____ Referred to the vertical files in the library
_____ Viewed films and slides
_____ Conducted experiments
_____ Wrote to the Bureau of Plants and to the Bureau of Forestry for materials
_____ Interviewed the garden teacher
_____ Interviewed other resource persons living in the community
_____ Joined field trips

Example 2 (66): These are simple illustrations of abbreviated checklists containing a group of "expected desirable forms of behavior" in the area of health habits.

Directions: Check whether the pupil has good health habits for each of the following.

Word Type	Phrase Type	Sentence Type
Teeth	Brushed teeth	He brushes his teeth each morning.
Hair	Combed hair	He combs his hair each morning.
Nose	Cleaned nose	He has a clean nose each morning.
Eyes	Cleaned eyes	He has clean eyes each morning.
Ears	Washed ears	He has clean ears each morning.
Etc.	Etc.	Etc.

Example 3:

Checklist for Good Health Habits Grade VI-3 Teacher: Miss D. Marcos Year: 1966 Children's Names	Clean hands	Clean and well-trimmed fingernails	Suitable clothes	Clean and neat clothes	Clean teeth	Clean neck	Clean feet	Clean and suitable footwear	Clean socks	Well-combed hair	Carries a clean handkerchief
1. Alberto, Zoilo											
2. Carlos, Jose											
3. Castano, Gil											
4. Lopez, Francisco											
5. Palanca, Miguel											
6. Portillo, Victorio											
7. Santos, Federico											
8. Tangco, Ruben											
9. Ventura, Rogelio											
10. Vital, Paolo											

Rating Scales

Rating scales are like checklists except that they introduce the factor of quality or the degree to which a characteristic or behavior item is present. The same behaviors listed in the checklists can be rated on a scale ranging from excellent to poor.

Teacher Rating Evaluation Forms

In using rating scales, the teacher thus has the added advantage of being able to evaluate the degree with which the children are developing desirable behaviors. Below are examples of rating scales.

Example 1: Descriptive Rating Scale

Name: Date:

	All the Time	Most of the Time	Occasionally	Never
1. Uses pedestrian lanes in crossing streets.				
2. Walks on sidewalks.				
3. Heeds traffic signs.				
4. Looks both ways before crossing a street.				
5. Crosses streets at the corner.				
6. Avoids sitting on the side of the street				
7. Avoids playing on the street.				
8. Does not steal rides on moving vehicles.				
9. Avoids walking on the railroad track.				
10. Does not ride bicycles or scooters on busy streets.				

Example 2: Graphic Rating Scale

Experiments

1	2	3	4	5
Always accurate in his measurements		Usually accurate in his measurements		Frequently inaccurate in his measurements

1	2	3	4	5
Always checks results of experiments		Usually checks results of experiments		Does not check results of experiments

Self-Rating Evaluation Forms

One evidence of good teaching is the amount of responsibility which each pupil assumes for his own progress (72). This can be encouraged by setting the stage for a pupil evaluating his own work as well as in having pupils share in the evaluation of the work of others. The use of checklists and rating scales gives the children an opportunity to rate themselves or their accomplishments. Take for instance the development of good health habits. A rating scale similar to the one given below may be developed in class and then used by the children to help themselves evaluate their own or a classmate's progress towards this behavioral goal.

Example 1: Am I Clean and Well-Groomed?

Directions: Answer each of the following questions by putting a checkmark under the appropriate item.

	Always	Usually	Occasionally	Never
1. Is my hair well combed?				
2. Are my teeth clean?				
3. Are my ears clean?				
4. Is my neck clean?				
5. Are my fingernails clean and well-trimmed?				
6. Are my hands clean?				
7. Are my clothes suitable?				
8. Are they clean and neat?				
9. Are my socks clean?				
10. Do I wear clean and suitable footwear?				
11. Are my feet and toenails clean.				
12. Do I carry a clean handkerchief?				

Example 2 (73):

Things I have Done This Year Because I am Interested	Never	Few Times	Sometimes	Many Times
1. Spent extra time on the science homework because I like it.				
2. Observed and studied animals and plants because I like to.				
3. Performed science experiments because I like to.				
4. Volunteered to answer questions in science class because I'm interested in the topics.				
5. Read additional science books and magazines because I'm interested.				
6. Collected specimens because I like to.				
7. Indulged in some science hobbies because I like to.				
8. Participated in science fairs or class exhibits.				

Example 3: Attitude towards beliefs and practices.

Directions. The following statements represent opinions that you often hear. Indicate how you feel about each statement immediately after you read it. Do not pause too long on any one of them. Mark your answer sheet as follows:

A - believe strongly
B - believe but interested in more evidence
C - uncertain about it
D - do not believe at all

1. A tree planted during the full moon will bear plenty of fruits.
2. Owls bring bad luck.
3. A conceiving woman who develops a strong liking for the fruit of a certain tree will cause that tree to be sterile or to bear sour fruits.
4. Floods and earthquakes are punishments from God.
5. Comets are the harbingers of war, famine, or pestilence.

Johnson (72) also mentioned another instance by which self-evaluation methods may be encouraged. This is in connection with the checking of children's notebooks. This job he says need not be a tedious task for the teacher if he has discussed and stressed certain standards for notebook work. A rating sheet on which each factor related to a standard is mentioned and where there is a place to indicate how well this standard has been met may be used. For a child's written work, three separate ratings may be given -- one by the pupil himself, the second rating by another pupil, and the third by the teacher. It may not be necessary to rate all the notebooks each time they are called in. An inspection of the pupil ratings and a careful rerating now and then by the teacher will be sufficient.

Questionnaires and Inventories

Questionnaires and inventories are methods designed to obtain information from children by means of a series of questions to which the responses are written (66). The questionnaire is a list of planned written questions that are related to a particular objective. Space is provided for indicating the response to each question. It is commonly used in evaluating children's science interests, attitudes and feelings. The inventory is similar to the questionnaire. It is a structured check-list in which the respondent writes, encircles or underlines his responses (66).

Questionnaires and inventories are useful to the teacher when there is insufficient time to interview each child personally. They are also useful in securing a picture of the status of a science experience. For instance, the teacher may want to know how many children follow hobbies, participate actively in certain activities, view suggested TV programs, make collections, etc. A major value of a written questionnaire in a class situation is the privacy accorded each response. Below are examples of a questionnaire and an inventory. The forms used are similar to those suggested by Wrightstone (66).

Example 1: Direction: The following questionnaire includes some science activities which Grade VI classes have undertaken during the year. Indicate whether you like the activity, are indifferent to it, or dislike the activity.

L means like - I means indifferent - D means dislike

1. Went on field trips.
2. Participated in class discussions.
3. Performed experiments.
4. Gave demonstrations.
5. Interviewed and listened to resource persons.
6. Read references and other reading materials in the library.
7. Participated in class and school exhibits.
8. Made collections.
9. Viewed films and slides.
10. Observed and took care of plants and some pets.

Example 2: The Agree-Disagree Inventory

The pupil indicates his agreement or disagreement with a series of statements. A quantitative measure of attitude may be obtained by determining the number of positive statements the pupil accepts and the number of negative statements he rejects.

Directions: Below are statements concerning some school practices. If you agree with the practice stated circle the A, if you disagree circle the D; if you are uncertain circle the U.

A U D 1. Prohibiting school children from buying food from outside vendors during recess.
A U D 2. Not selling carbonated drinks in school.
A U D 3. Supervising lunch activities in the room.
A U D 4. Encouraging children who have common colds to stay at home.
A U D 5. Requiring all school children to submit to physical and health examinations each year.
A U D 6. Giving smallpox, anti-typhoid-cholera-dysentery injections to school children.
A U D 7. Requiring medical certificates from children who have been sick with communicable diseases.
A U D 8. Not exempting children from the physical education period.
A U D 9. Requiring all children who are seeking admission to public schools to submit to thorough physical and health examination.
A U D 10. Serving free lunch to school athletes.

Example 3: The form used in this questionnaire is similar to one of the forms suggested by Krathwohl, Bloom and Masia (68).

Directions. The purpose of this questionnaire is to know what you really think about the lessons you are studying in your science classes. Since there are no right and wrong answers to the questions you are to express your honest feelings about them. There are three ways to work your answer sheet.

Y means that your answer to the question is Yes
U means that your answer to the question is Uncertain
N means that your answer to the question is No.

1. Have you learned all that you want to know about plants and animals?
2. Do you want to read additional materials about plants? about animals?

3. Were the lessons on insects important to your life?
4. Do children need to know the structure and characteristics of common plants and animals?
5. Do you want to do more experiments on plants?
6. Will you be interested in planting and keeping a garden for yourself?
7. Would you want to keep an aquarium?
8. Do you want to own a birdhouse and take care of birds?
9. Will it be fun to hunt for birds' eggs and birdies?
10. Should our forest laws be enforced at all times?

Interviews

The interview is designed to obtain data in a face-to-face relationship. It is a valuable means of diagnosing pupil behavior. An advantage of it over the questionnaire is its flexibility. It allows the interviewee to ask for clarification of a question and the interviewer to raise all kinds of follow-up questions to the answers of the respondent. Sometimes the responses which are given may stimulate the interviewer to raise questions which he had not thought of at the start of the interview. Another advantage of the interview is the opportunity it gives the interviewer to hear not only what the child has to say but also how he says it. Interviews need not be formal. The casual interview with a student in the classroom will greatly help the teacher in diagnosing pupil behavior (66).

Matthews (49) used the interview technique to evaluate third grade children's understanding of some science terms and principles. She set up science situations in the form of games, pictures and questions and encouraged children to talk freely about them.

Oakes (2) also used the interview technique in finding out how young children explain natural phenomena. He stimulated discussion through verbal questions and simple demonstrations.

The interview technique was suggested by the Forty-Fifth Yearbook of the National Society for the Study of Education, The Measurement of Understanding (69) for appraising children's progress towards the development of good health habits. Interview with camp counselors and parents to determine whether children go to bed willingly, give up TV and radio programs that interfere with their sleep, brush their teeth after each meal, sleep with windows open, and practice other health habits was listed as a useful device for evaluating children's attitudes and health habits.

Children's Work Products

Another significant way of finding out how well children are meeting the objectives of the science program is the teacher's examination of the material which the children produce (19). What a child does and what he produces can give much evidence about his thinking, attitudes and interests (19). Samples of children's creative work such as writings, drawings, models, exhibits and other projects supply considerable information about their concepts, understandings, and thinking processes. A teacher evaluates a science report not by its length but rather by the accuracy of the information, the thoughtful organization and clear explanation of the material being presented.

Science exhibits are not judged by the artistic quality of the finished products displayed but on the basis of the processes used by the children in preparing and putting up the exhibits -- on their ability to make use of and demonstrate principles learned, their ability to organize and classify materials in a sensible and reasonable way. Experiments children design and the models which they construct are demonstrations of how well they are thinking and how well they understand the scientific principles they are studying.

Only as the teacher knows clearly the kind of behavior he eventually expects from his children, and only as he helps his pupils carry out projects which lead to this kind of behavior can he develop an adequate basis for evaluating the work which his children produce (19).

Informal Techniques

Evidences of children's growth towards certain behavioral objectives can also be obtained through the use of informal techniques. The following are examples of informal procedures suggested by The Forty-Fifth Yearbook of the National Society for the Study of Education, The Measurement of Understanding (69) for evaluating certain attitudes and understandings of children in science.

1. Analyzing records of food eaten daily by children (amount and type) and observing what they eat during the recess period.

2. Examining the records of the sale of milk, fruits, carbonated drinks, candies, etc., in the school cafeteria.

3. Examining children's health records and reports from physicians, dentists and nurses.

4. Studying reports of parents about the health habits of children.

5. Listening to children's discussion of foods they like and dislike.

6. Visiting homes of children to determine the healthfulness of surroundings and steps taken by the children to improve unhealthful conditions.

7. Studying the attendance records to determine the illnesses that keep children from school.

8. Observing and recording from time to time the behavior of children with reference to sneezing, using a handkerchief, putting things in their mouths and using drinking cups.

9. Taking note of the reactions of children toward immunization when it is done at school -- whether there is evidence of greater acceptance and understanding.

10. Keeping a record of the injuries children report and noting whether they show increasing recognition of the conditions which require the exercise of care.

11. Taking note of how many children have made a survey of safety hazards in their homes and have done something to correct them.

12. Asking junior police and boy scout patrols to record violations of safety rules and comparing their records from time to time.

13. Studying safety practices of children such as use of scissors, throwing stones, leaving materials and equipment where they may cause falls, and noting improvement throughout the year.

14. Determining if children appreciate variations in height and weight gains among their own group through analysis of individual height-weight graphs.

15. Collecting evidence from parents regarding children's hours of study, work and recreation and noting if the times for study, work and recreation fit into a well-balanced and healthfully scheduled day and week.

16. Observing and taking note of children who use common combs, drinking glass or wear each other's clothes and footwear.

17. Observing periodically methods of food handling employed by children working in the school kitchen.

18. Determining changes in food practices through periodic pupil reports such as "What I Ate Last Week."

19. Noting the number of students who voluntarily see their physician and dentist at regular intervals for treatment or to obtain health examination.

Lichtenstein (74) analyzed the diaries which children were asked to keep of their activities in attempting to test the success of stressing an attitude.

Louise Lee (75) evaluated science interests by recording pictures, books, and animals brought to school by children for classmates to observe and by taking note of spontaneous expressions of ideas and understandings made by children during class discussions.

CHAPTER IV

PROBLEMS, SPECIFIC CONTENT OBJECTIVES, AND SUGGESTED EVALUATIVE TECHNIQUES AND PROCEDURES FOR THE FOURTEEN TEACHING UNITS SUGGESTED IN THE SIXTH GRADE PHILIPPINE COURSE OF STUDY

In Chapter II, the major purposes for science teaching were formulated and stated. The main goals fall under two categories -- helping children learn basic science information and developing desirable behaviors in the process. Both types are vital and one is meaningless without the other. Hence, definite provision was made to devise evaluative instruments and techniques for measuring pupil achievement in both types of objectives.

An important task undertaken before developing evaluative devices and procedures suggested in this study was to translate each major goal stated in Chapter II into more specific objectives. Purposes stated in very general terms are vague, unclear, and too comprehensive to be evaluated. Before a teacher can determine whether a child has achieved certain objectives, he must be able to identify specifically what the pupil was supposed to achieve. For example, "to help children learn basic science facts, concepts, generalizations or principles" which is the first major goal stated in Chapter II, has little meaning and would not be useful as a guide for evaluation. This must be stated in more specific terms. What science information are the children expected to learn? Have they learned the uses of trees? Do they know why the sun, the moon, and the stars seem to move across the sky? Have they learned ways and means of protecting and conserving trees and useful animals? To be of more help to classroom teachers, each unit in the course outline must spell out clearly the science content to be learned.

To determine the specific content objectives, the following steps were undertaken. The units or content suggested in the Philippine Course of Study which have been selected to achieve the general goals were studied. Problems pertinent to the study of each unit and which children are likely to raise were anticipated. These were stated at the beginning of each unit. Then basic science information -- facts, concepts, generalizations or principles -- which were important to teach to help children solve the problems were listed and stated as specific content objectives for each unit. In addition to the activities suggested in the Philippine Course of Study, additional experiences which will help attain both content and behavioral objectives were worked out. While these activities and the materials suggested are important parts of the units developed, they were not considered a vital part of the study and were therefore not included.

From the findings of the survey of related literature, devices, techniques and procedures appropriate for evaluating pupil growth towards the specific content objectives were selected, adapted, and developed. Sample objective and essay tests and non-testing procedures were devised and organized by experience areas. These are found in the Appendix under the following headings.

Appendix A -- Evaluative Devices for Experience Area 1 - Plants Animals. This area includes the following related units.

Unit I -- Trees Around Us
Unit II -- Our Aquatic Animals. Their Protection and Conservation
Unit III -- Our Work Animals
Unit XI -- Birds and Fowls
Unit XII -- Air Plants
Unit XIII -- Plants for Food
Unit XIV -- Useful and Harmful Insects

Appendix B -- Evaluative Devices for Experience Area 2 - The Weather. This area covers Unit IV -- Air and Its Importance to Life.

Appendix C -- Evaluative Devices for Experience Area 3 - The Earth and Beyond. This area includes Unit VI -- The Universe, Our Solar System.

Appendix D -- Evaluative Devices for Experience Area 4 - Ways and Means (Practical, Mechanical, Electrical). This area covers Unit V - Common Mechanical and Electrical Devices Used in the Home and Industry: Heat and Light.

Appendix E -- Evaluative Devices for Experience Area 5 - The Human Body and Its Care. This area includes the following related units:

Unit VII -- Safety First: First Aid
Unit VIII -- The Right Kinds of Food: Their Selection and Preparation
Unit IX -- Body Structure and Growth
Unit X -- Communicable Diseases and Other Illnesses Affecting the Different Organs of the Body

A coded listing of evaluative devices and procedures which may be used for evaluating each specific content objective are given at the end of each of the 14 units suggested in the Philippine Course of Study.

The following are the 14 units. Each unit includes the problems, specific content objectives and a coded listing of evaluative devices and procedures for evaluating each content objective.

Experience Area 1 - Plants and Animals

Unit I - Trees Around Us

Problems

A. Why are trees important to men and other animals?

B. What trees are found in your locality?

  1. What are their characteristics?
  2. How do they differ from each other?

C. How can we protect and conserve trees?

  1. What things injure and destroy trees?
  2. What are the different ways of conserving and protecting trees and forests?

D. Why was the narra selected as the National Tree of the Philippines?

Objectives

A. To know and understand that:

  1. much of our food comes from trees and other plants.
  2. trees and other plants give us clothing materials.
  3. many of the materials used for building houses and for making common articles used at home come from trees and other plants.
  4. most of our forest products come from trees.
  5. most kinds of paper are made from the pulp of trees.
  6. we use trees and other woody plants as firewood.
  7. trees give us shade and beautify our surroundings.
  8. parts of some trees and other plants are used for medical purposes.
  9. trees are important in the conservation of soil because they help to prevent erosion.
  10. trees are used as homes by some animals.

B. To learn the distinguishing characteristics of trees

  1. To be able to observe and note accurately the distinguishing characteristics of trees.
  2. To be able to make valid comparisons and report accurately the descriptions of certain trees.

C. To know that trees have many enemies -- man, animals, insects, fire, and plant disease which injure them.

D. To know the different ways of protecting and conserving trees.

E. To know that the narra was selected as the National Tree of the Philippines because of its popularity, utility, aesthetic value, hardiness, rapidity of growth, nativity, and history.

Evaluative Techniques and Procedures

Below are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- and non-testing devices indicated under each objective are found in the Appendix under the experience area -- Plants and Animals.

1. Objective 1
   (a) Objective tests -- See items II-A-3, 7, II-D-1, III-A-4, 5; III-C; IV-B-1; IV-H; IV-1-1,4.
   (b) Essay tests -- See numbers 1, 3, and 7.
   (c) Non-testing procedures -- See B-2.

2. Objective 2
   (a) Objective tests -- See items II-A-1, 2, 4, 5, II-B-1,2; II-C-3, II-E-1, 2.

3. Objective 3
   (a) Objective tests -- See items II-A-1, 2; III-A-3.

4. Objective 4
   (a) Objective tests -- See items III-A-2, 6.
   (b) Essay tests -- See number 6-b.
   (c) Non-testing procedures -- See A-1, B-1; C-3, 5.

5. Objective 5
   (a) Objective tests -- See item C-1.

Unit II - Our Aquatic Animals: Their Protection and Conservation

Problems

A. What are the distinguishing characteristics of each class of aquatic animals?

B. How are the various parts of the body of an aquatic animal adapted for protecting itself from its enemies, for securing food, and for moving about?

C. Why are aquatic animals important to man?

D. What are the different ways and means of conserving fish and other forms of aquatic animals?

E. What efforts have men made in exploring the oceans?

Objectives

A. To know that:

1. most fish are covered with scales, they have backbone and breathe with gills.

2. most shellfish or mollusks have a protective shell for body covering, they have muscular foot, soft, fleshy body and a special sheet of tissue called the mantle which produces the shell.

3. arthropods have skeletons on the outside of their bodies; they have segmented bodies and legs that are jointed and can bend.

4. amphibians have backbones; they have slippery skin that may be smooth or rough; they breathe with gills when they are young and with lungs when they are grown.

B. To know that the various parts of the body of an aquatic animal are adapted for securing food, for moving about and for protecting itself from its enemies.

1. Most fish have large eyes and large mouths with sharp teeth that slant backward toward the throat.

2. A fish swims by moving its tail and fins, its air bladder makes possible for it to rise, sink or stay at a particular depth.

3. The bodies of most fish are covered with scales.

4. The skin of a fish gives off slime which protects the fish from being attacked by enemies in the water.

5. Many fish are dark colored on top and light colored underneath which helps prevent them from being seen by their enemies.

6. Many deep-sea fish have odd shapes; they are small and very dark in color, they have light organs and very large mouths and eyes that are sensitive.

7. Most mollusks have a protective shell for body covering, some have many arms called tentacles and when attacked can shoot out an inky material that makes the water cloudy.

8. Most shellfish have a tough muscular foot which is used for digging and moving about.

9. Some have a rough tonguelike structure that is used for scraping off food, others have a sharp beak that they use for biting off pieces of food.

10. Arthropods have an outside skeleton made of tough material which covers their bodies, they have eyes made up of many lenses and feelers called antennae.

11. They have appendages that are jointed and can bend and mouth parts that are used for holding, cutting, grinding, and pushing the food inside their bodies.

12. Amphibians have a tough slippery skin that is usually moist and colored like the surroundings in which they live.

13. They have two pairs of appendages attached to their bodies; their feet are often webbed.

14. They have a large mouth and a long sticky tongue attached to the bottom in front for catching insects for food.

C. To know that:

1. many aquatic animals are valuable to man as food.

2. some aquatic animals are ground up and sold for animal feed.

3. some aquatic animals are useful as scavengers.

4. fish oil is rich in Vitamin A and D: it is also used in making certain paints.

5. the bones and waste parts of fish are used to make glue.

6. certain oysters make pearls, the inner surface of their shells are used to make buttons and mother-of-pearl.

7. amphibians feed on insects that destroy garden plants.

8. many persons catch fish for sport and recreation.

D. To learn that:

1. fish can be preserved by salting, drying, smoking, canning,

and refrigeration.

2. the supply of fish can be conserved through proper ways of fishing.

3. the government is enforcing laws and other measures to help conserve our fish supply.

E. To know that man can adapt for life under water.

   1. To know the vehicles and apparatus that have been invented to help men in exploring the oceans.

   2. To know the value of these explorations in our daily lives.

   3. To know the contributions of scientists in ocean exploration.

Evaluative Techniques and Procedures

Below are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- and non-testing devices indicated under each objective are found in the Appendix under the experience area -- Plants and Animals.

1. Objective 1
   (a) Objective tests -- See items II-A-30, 31, 34; II-F-3,4, 5,8; II-H-4, II-I-2, III-D-2.
   (b) Essay tests -- See item II-b.

2. Objective 2
   (a) Objective tests -- See items II-A-35, 38, II-H-2-a, d, g, i; II-H-3; II-H-4; III-D-2; III-F-2, 10.
   (b) Essay tests -- See items 9-b; II-b.

3. Objective 3
   (a) Objective tests -- See item II-A-33.
   (b) Essay tests -- See item 2-b; 10-b.

4. Objective 4
   (a) Objective tests -- See items II-K-2; III-C-2, III-8-b.
   (b) Essay tests -- See item 12-b.
   (c) Non-testing procedures -- See C-7.

5. Objective 5
   (a) Objective tests -- See items II-A-36, 37, 39, 40.

Unit III - Our Work Animals

Problems

- A. What are our important work animals?
  - 1. What characteristics do they have in common with other animals?
  - 2. How do they differ from other mammals?
  - 3. What special adaptations do they possess?
- B. What are some of the important needs of work animals?
- C. How do our work animals help us?
- D. How should we protect and take care of our work animals?

Objectives

- A. To learn that the horse, the carabao and the cow are our important work animals.
  - 1. To know that:
    - (a) these animals have characteristics that are common in many animals.
      - (1) All of them have backbones.
      - (2) They have hair on their bodies.
      - (3) They are warm blooded.
      - (4) They can feed their young with milk from their bodies.
      - (5) They take air into their bodies by way of their lungs.
    - (b) animals with these characteristics are called mammals.
  - 2. To be aware that these animals have special characteristics that make them in some ways different from other mammals.
    - (a) They have hoofs instead of toes.
    - (b) The cow and the carabao have a pair of hollow horns.
    - (c) They eat only plants and plant products and are called herbivorous.
  - 3. To learn that:
    - (a) Horses have wide closely spaced front teeth used principally for cutting and grasping.
    - (b) The upper front teeth of cows and carabaos have been modified into hardened plate. They grasp their food with their lips and tongue and use their lower front teeth for cutting them.

- (c) Horses, cows, and carabaos have strong, large, flat surfaced molars which work well in grinding grass, plant stems, palay, and other grains.
- (d) They have tough skin covered with hair which protects them from heat and cold.
- (e) They have hard hoofs which are fitted for walking long distances.
- (f) The long slender legs and body of a horse enables it to kick and to run fast.
- (g) The strong heavy body and short stocky legs of the carabao enables it to do heavy work.
- (h) They all have long tails that they use to help protect themselves from annoying insects.
- (i) The cows and the carabaos have horns which they use for protection.

B. To understand that work animals need:

1. plenty of food and water to drink.
2. rest and sleep after periods of work.
3. a clean shelter to stay in.
4. an open space to graze in.
5. the protection and care of man.

C. To know that:

1. horses are mostly used for transportation.
2. carabaos help on the farm.
3. horses and carabaos are used to carry heavy loads.
4. cows, carabaos, and some horses provide food.
   - (a) cows and carabaos give milk, cheese, and butter.
   - (b) their meat is eaten.
5. cows and carabaos give us leather.
6. buttons and bone ornaments are made from the bones and horns of cows and carabaos and the bones of horses.
7. all these animals supply us with fertilizer.

D. To know that we can protect and take care of work animals by:

1. giving them enough food and water to drink.
2. allowing them to rest and sleep after periods of work.
3. providing them a clean place in which to live.
4. giving them regular baths and brushing them every day.
5. neither overworking nor overloading them.
6. providing medical care when they are sick.
7. treating them kindly.

Evaluative Techniques and Procedures

The following are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items --

objective and essay -- and non-testing devices indicated under each objective are found in the Appendix under the experience area -- Plants and Animals.

1. Objective 1
    (a) Objective tests -- See items I-7; II-A-24, II-B-3, II-C-6; II-E-2; II-H-3, 5, 6, 10, III-F-1.

2. Objective 2
    (a) Essay tests -- See item 5-c.

3. Objective 3
    (a) Objective tests -- See item IV-1-5.
    (b) Essay tests -- See item I-d.

4. Objective 4
    (a) Essay tests -- See item 5-c.
    (b) Non-testing procedures -- See C-1,2.

Unit XI - Birds and Fowls

Problems

A. How are birds and fowls adapted to the life they lead?

B. How does the body structure of a bird or a fowl compare with that of other animals?

C. Why are birds and fowls important?

D. What are the different ways of protecting and conserving useful birds and fowls?

Objectives

A. To learn that the various parts of the body of birds and fowls are adapted to the life they lead.

    1. To know that birds and fowls:
        (a) have bodies covered with feathers.
        (b) have a very light skeleton with hollow bones filled with air which makes it easier for them to fly.
        (c) have wings suitably fitted or adapted for the kind of flying they do.
        (d) have horny beaks that are specially fitted or adapted for gathering their food and eating.

(e) have two legs and different kinds of feet, depending on whether they are fitted or adapted for perching, climbing, swimming, wading, or grasping.
(f) have tails that help in flying and in perching.
(g) are warm-blooded, which means that their body temperature does vary as the result of changes in the temperature of the air about them.

B. To know that:

1. like mammals and amphibians, birds and fowls have lungs and breathe air.
2. like mammals they are warm-blooded animals.
3. like amphibians, fish, and mammals they have backbones with the skeleton inside their bodies.
4. like most amphibians and many mammals, they have two pairs of appendages, like some mammals they stand on two legs.
5. only birds have feathers.
6. unlike most mammals and amphibians, birds and fowls have wings instead of front legs.
7. unlike most animals, they have beaks, but no teeth.
8. unlike most mammals they produce their young by laying eggs.

C. To learn the importance of birds and fowls.

1. To know that some birds and fowls.
   (a) eat harmful insects, mice, and weed seeds.
   (b) are scavengers -- eating dead animals, dead fish, and garbage.
   (c) are used for food.
   (d) lay eggs that are used for food.
   (e) helped during the war.
   (f) are kept as pets.

2. To realize that in spite of the harm done by some birds, they are, as a class of animals, considered beneficial.

D. To learn that we can protect and conserve useful birds and fowls by:

1. avoiding the shooting and killing of birds and fowls for fun.
2. sparing birds' nesting sites and food supply as much as possible.
3. making birdhouses and feeders in our yard.
4. leaving birds' eggs and birdies alone.
5. allowing the shooting of game birds only at certain times of the year.

Evaluative Techniques and Procedures

Below are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- and non-testing devices indicated under each objective are found in the Appendix under the experience area -- Plants and Animals.

1. Objective 1
   (a) Objective tests -- See items II-H-1, 2; II-H-5, III-E; IV-E-2.
2. Objective 2
   (a) Objective tests -- See items II-1; III-F-4, 7, 8.
   (b) Essay tests -- See item 17.
3. Objective 3
   (a) Objective tests -- See item II-G-1.
   (b) Essay tests -- See item 19-b.
4. Objective 4
   (a) Objective tests -- See item II-G-1.
   (b) Non-testing procedures -- See number 4.

Unit XII - Air Plants

Problems

A. What are the characteristics, habitat, and needs of air plants common in the locality?

B. How do air plants differ from other plants?

C. How will you take care of orchids and common ferns?

D. What are some of the uses of orchids and ferns?

Objectives

A. To learn that.

1. most orchids are air plants, but some grow on the ground.
   (a) they grow on trees or rocks above ground level.
   (b) they are not parasites and do not feed on the host trees.
2. an orchid plant is like other green plants -- it has roots, stems, leaves, and flowers.

(a) orchid leaves vary in size, shape, color and texture.
  (1) some are long and narrow
  (2) some are dark and leathery
  (3) some are small and fragile
(b) orchid roots are greenish or white, they are fleshy with a spongy covering layer.
(c) the flowers are of different color; they vary in size and shape.

3. ferns are commonly known as air plants but some of them grow on the ground.
  (a) they have roots, stems, and leaves but bear no flowers.
    (1) fern leaves are called fronds
    (2) the stems are underground and so the leaves are the only visible parts of the plant

B. To know that air plants differ from other plants in some ways.

1. Most orchids do not need frequent watering they are equipped to store up reserves of food and moisture.
2. Orchids can grow without soil they get their food from rain, dust, decaying materials that come their way.
3. Many orchids do not branch out from a stem, they grow sideways.
4. Unlike other flowers, the sepals of an orchid are attractive like the petals; they come in all colors except black.
5. Most ferns reproduce by spores some reproduce by runners and shoots.
6. Unlike other plants, the tip of the growing fern frond is tightly coiled, it unfolds slowly as the leaf grows.

C. To learn that:

1. ferns grow best in moist, shady places.
2. orchids need sunshine, they grow best in areas of maximum sunshine in the morning.
3. orchids are air plants so fresh air is important, they like warm moist air.
4. orchids need air at their roots, too, this is why they are grown in baskets or pots with more drainage holes.

D. To know that

1. ferns are ornamental plants.
  (a) fronds are gathered for table and counter decorations.
  (b) they are used by florists as 'greens to go with bouquets.
2. ferns help hold and form soil.

3. orchids make beautiful corsages.
4. true vanilla comes from the beanlike fruit of the orchid Vanilla.
5. some orchids are used for medicinal purposes -- as remedy for sores, in the treatment of skin infection; as an emetic or diuretic and to expel tapeworms.

Evaluative Techniques and Procedures

The following are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- and non-testing devices indicated under each objective are found in the Appendix under the experience area -- Plants and Animals.

1. Objective 1
   (a) Objective tests -- See items II-A-21, 22; II-C-4, 5. IV-A-2.

2. Objective 2
   (a) Objective tests -- See items II-C-4, 5.
   (b) Essay tests -- See number 8.

3. Objective 3
   (a) Objective tests -- See items II-C-4,5.
   (b) Essay tests -- See number 9.

4. Objective 4
   (a) Objective tests -- See items II-A-23, 32.
   (b) Essay tests -- See number 10.
   (c) Non-testing procedures -- See C-4.

Unit XIII - Plants for Food

Problems

A. Why are green plants important to all living things?

B. How do green plants make food?

C. What do plants do with the food they make?

D. How does the body make use of the foods it gets from plants?

E. How can we raise and help food-producing plants grow?

F. What are some of the non-green plants in the locality?

Objectives

A. To know that all living things depend directly or indirectly on green plants for food.

B. To learn that green plants with the help of sunlight make food out of water, carbon dioxide from the air, and minerals from the soil.

  1. To know that a plant takes in materials it needs through its roots and leaves.
  2. To learn that:
     (a) the energy needed to make food comes from sunlight.
     (b) food making in green plants known as photosynthesis takes place in the leaves and stems that contain a green substance called chlorophyll.
     (c) when sunlight shines on chlorophyll, the light energy is changed into chemical energy which causes carbon dioxide to combine with water to make sugar.
  3. To know that a green plant:
     (a) makes sugar from carbon dioxide and water in the presence of sunlight
        (1) It can change some of the sugar it does not need to starch.
        (2) It can make proteins and fats from sugar.
     (b) growing in sunlight can make vitamins.
     (c) absorb minerals from the soil and with sugar make other food substances.

C. To understand that plants themselves use some of the food they make.

  1. To know that plants need food in order to live and grow.
  2. To know that food which has not been used may be stored in different parts of plants -- in the roots, stems, leaves, flowers, fruits, or seeds.
  3. To be aware that people use the food that plants store.

D. To learn that the body makes use of the different substances we get from plants.

  1. To know that.
     (a) sugar, starch, and fat are fuel foods that give the body heat and energy.
     (b) protein is needed for growth and repair of worn out cells of the body.

2. To know that:
    (a) several kinds of minerals such as calcium, iron, and phosphorus are needed to keep our bones, hair, nails, teeth, and other parts of the body healthy and strong.
    (b) vitamin
        (1) A is necessary for good growth, healthy skin, and good eyesight.
        (2) B helps to digest food and keep the skin, blood, and nerves in good health.
        (3) C is important for healthy bones, lungs, teeth, and gums.
        (4) D is important to build good bones, nails, and teeth.

E. To know that:

1. the soil and the climate determine the kinds of plants that may be grown in a certain region.
2. (a) selecting better seeds to grow will improve the amount and quality of the plants we raise for food.
    (b) the soil must be cultivated so seeds can grow and so water can soak into the ground.
    (c) soil that is not too fine like loam will provide plants an adequate supply of air.
    (d) a kind of soil should be chosen that retains enough moisture without allowing water to displace needed air.
    (e) soil becomes worn-out and useless unless fertilized.
    (f) plants should be placed far enough apart so that they can get enough sunlight, air, and water.
    (g) plants must be protected from weeds and harmful insects.

F. To know some non-green plants found in the locality

1. To learn that
    (a) mushrooms and shelf-fungi are non-green plants.
        (1) they do not make their own food; they live on dead trees and other dead plants.
        (2) mushrooms like some ferns reproduce by spores.
    (b) Unlike green plants mushrooms do not have leaves, stems, or roots.
        (1) they have an umbrella-shaped top called cap which is attached to the stalk.
        (2) on the underside of the cap are fleshy gills which contains the spores.

2. To know that some mushrooms are good to eat, but others may be very poisonous.

Evaluative Techniques and Procedures

Below are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- and non-testing devices indicated under each objective are found in the Appendix under the experience area -- Plants and animals.

1. Objective 1
   (a) Objective tests -- See items II-A-7, IV-A.

2. Objective 2
   (a) Objective tests -- See items II-A-6, 8, 9, 10, 11, 12, 13, 15, 16, 17, 20; III-A-6; III-F-3, 5; IV-B-4; IV-C-1, 2,3; IV-D, IV-E; IV-G; IV-1-2.
   (b) Essay tests -- See 2,4.

3. Objective 3
   (a) Objective tests -- See items II-A-8, 9, 12, 15, 17, II-D-2; III-A-1, III-B-2, 5; IV-B-2; IV-C-1, 2, 3; IV-E; IV-F.
   (b) Essay tests -- See number 5.

4. Objective 4
   (a) Objective tests -- See items II-A-19; II-F-1, 2, 3, 4, 5.
   (b) Essay tests -- See number 6.

5. Objective 5
   (a) Objective tests -- See items II-A-14, 15, 16, 17, II-C-2, III-B-1, 2, 3, 4, 5; III-F-6, IV-C-1, 2, 3.
   (b) Non-testing procedures -- See A-2,3.

6. Objective 6
   (a) Objective tests -- See items II-A-18, III-D-1, IV-B-3.

Unit XIV - Useful and Harmful Insects

Problems

A. What are the distinguishing characteristics of insects?

B. How are insects adapted to the life they live?

C. How are insects helpful and harmful to man?

D. What are some ways of protecting useful insects?

E. What are some ways of controlling harmful insects?

Objectives

A. To learn that

1. all insects have three separate body regions -- the head, thorax, abdomen.
2. they have one pair of antennae or feelers attached to their heads.
3. they have six legs, all attached to the thorax.
4. they breathe through tiny openings along each side of the abdomen.
5. most insects have one or two pairs of wings.
6. most adult insects have eyes that see in all directions.

B. To know that:

1. some insects have mouth parts with hard jaws that are useful in biting and chewing, some have piercing and sucking mouth parts.
2. most insects move from place to place by means of their wings; others use their legs for crawling.
3. some insects have legs highly adapted for jumping, some have sticky hairs and claws on their feet that help them stay securely on walls and ceilings.
4. most insects have a keen sense of smell.
5. some live together and share the work.
6. many insects have colors or appearances that protect them from their enemies.
7. some have special traits and devices for protection -- jumping, snapping, death-feigning, motionless attitude, spinning or constructing types of coverings, excreting wax or offensive gases.
8. some insects have sensitive sense of hearing, they hear in several ways.
9. most adult insects have eyes that see all the way around.
10. some insects have strong bites because of their powerful jaws, others have a "sting" that gives off poison.

C. To know that:

1. some insects are beneficial to man.
    - (a) Many insects help in the pollination of plants.
    - (b) Bees produce honey and beeswax.
    - (c) Some insects eat harmful insects.
    - (d) Some insects are food of some useful animals.
    - (e) Silk moths give us silk.
    - (f) The lac insect gives us shellac.
    - (g) The bodies of some insects are ground up to produce dyes.
    - (h) Some insects are scavengers and feed on the dead bodies of animals.

2. Some insects are harmful to man.
    (a) Many insects destroy grain crops, vegetables and fruits.
    (b) Some insects destroy trees.
    (c) Some insects destroy wooden buildings and foundations.
    (d) Certain moths and beetles destroy clothes and clothing materials.
    (e) Some insects carry disease germs to man and animals.
    (f) Some insects are parasites of man and pet animals.
    (g) Some insects contaminate food.
    (h) Some insects annoy man and animals by stinging and biting.

D. To know the different ways by which we can help and protect useful insects.

1. Useful insects should not be caught for the mere fun of catching them.
2. Their homes and nests should be left unmolested.
3. Several things should be taken into consideration before killing a certain insect.
4. We do not always need to catch insects in order to study them, they can be observed in their natural environment.

E. To learn that harmful insects can be controlled by:

1. Destroying the environment in which they live.
2. Using insecticides that kill them.
3. Importing natural enemies or making use of local natural enemies.
4. Using quarantine laws to prevent the entrance of harmful insects into a country.

Evaluative Techniques and Procedures

The following are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- and non-testing devices indicated under each objective are found in the Appendix under the experience area -- Plants and Animals.

1. Objective 1
    (a) Objective tests -- See items II-A-25, 26, 27, 28, II-C-7, II-F-2, III-F-9.

2. Objective 2
    (a) Objective tests -- See items II-C-8, II-J.

3. Objective 3
    (a) Objective tests -- See items IV-1-6.
    (b) Essay tests -- See number 18.

4. Objective 4
    (a) Non-testing procedures -- See number 5, C-6, II-A-29.

5. Objective 5
    (a) Non-testing procedures -- See number 5; C-6.

Experience Area 2 - The Weather

Unit IV - Air and Its Importance to Life

Problems

A. What are the important characteristics of air?

B. Why is air important to life?

C. What is the cause of weather?
    1. What contributes to the changes in the earth s atmosphere?
    2. What chiefly determines our weather?

D. What is the work of the Weather Bureau?

E. How does the Weather Bureau help us?

Objectives

A. To learn that·
    1. air is all around us, we can feel it but we can't see it
        (a) there is air in the soil
        (b) there is air in water
    2. air can move things
        (a) wind is moving air
        (b) wind pushes on things
    3. air has weight
    4. air occupies space
    5. air exerts pressure

B. To know that air is important to living things
    1. man, animals, and plants cannot live without air
    2. we use air in many ways

C. To understand that changes in the atmosphere of the earth result in weather.
    1. that heat, pressure, winds, and moisture contribute to changes in the atmosphere

   2. that the heat energy of the sun chiefly determines our weather

D. To know that the Weather Bureau

   1. makes weather observations and reports
   2. draws weather maps and sends them to different places that need detailed information about the weather
   3. gives typhoon, tornado, and storm warnings
   4. provides farmers with weather and crop bulletins
   5 forecasts floods
   6. offers special information and forecasts for planes and ships

E. To know that the Weather Bureau helps people in many ways

   1. its daily forecasts help people plan their daily activities better.
   2. it helps railroads, trucks, and ships protect shipments of perishable foods.
   3. it gives warnings to plane and other travelers.
   4. it gives gas, light, telephone, and power companies the chance to be ready for extra service when a storm is coming.
   5. it gives farmers a chance to save their crops from being destroyed.
   6. it helps save lives by warning persons of typhoon, tornadoes, and floods.

Evaluative Techniques and Procedures

Below are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- indicated under each objective are found in the Appendix under Experience Area 2 - The Weather.

1 Objective 1
   (a) Objective tests -- See items II-A-1, 2, III-A-1, 2, 3, 4, 5; III-B-4, 5; IV-A-1, 2; IV-C; IV-D-1, 2, 4. IV-E. IV-G-2, 3. V-A.

2. Objective 2
   (a) Objective tests -- See items I-3, 9. IV-D-3, 5. IV-G-6, 8.
   (b) Essay tests -- See item 4.

3. Objective 3
   (a) Objective tests -- See items I-1, 2, 4, 5, 6, 7, 8, 10. II-A-3 through 15, II-B-1 through 7. III-B-3, IV-B; IV-F, IV-G-1, 4, 5, 7.

4. Objective 4
   (a) Objective tests -- See items 1-4; III-B-1, 2.
   (b) Essay tests -- See items 2, 3.
5. Objective 5
   (a) Essay tests -- See item 1.

Experience Area 3 - The Earth and Beyond

Unit VI - The Universe, Our Solar System

Problems

A. What is the solar system?

B. How is the sun related to its planets?

C. What is known about the solar system?

D. What are some essential facts about gravitation?

E. How do eclipses of the moon and the sun take place?

F. What is beyond the solar system?

Objectives

A. To know that:

1. the sun, its nine planets and their moons, the planetoids, the comets and the meteors, that travel around the sun, make up the solar system.
2. the solar system is only a part of the universe which in addition includes other stars and everything in space.

B. To learn that:

1. the sun is near the middle of the solar system. It is made of very, very hot gases. It helps to tell directions and time on earth.
2. the earth and other planets travel around the sun. Some are farther away from the sun than the earth and others are nearer the sun. The sun s gravity helps to hold them in their orbits.
3. the members of the solar system we know best are the earth, its moon, and the sun.

C. To know that:

1. Mercury, the smallest and the closest planet to the sun, is the swiftest in completing one orbit. It revolves around the sun once every 88 days and rotates on its axis once during this 88 days, so its day is just as long as its year.
2. scientists think that Mercury has no air or water.
3. Venus, the next closest planet to the sun, is about as big as Earth. It can be seen near the horizon as an "evening" star just after sunset and as a "morning" star just before sunrise. As seen from the earth, Venus is the brightest planet.
4. it revolves around the sun once every 225 days and because it is surrounded by thick clouds astronomers have not been able to know exactly how long it takes it to rotato once on its axis.
5. Earth is the next planet after Venus from the sun and is about 93,000,000 miles from the sun.
6. it rotates on its axis once every 24 hours and revolves around the sun once in 365 1/4 days which is called a year.
7. Earth has one moon.
8. it is probably the only planet where life, as we know it, exists.
9. Mars is the closest planet to Earth but much smaller than Earth. It revolves around the sun once every 687 days and rotates on its axis once every 24 1/2 hours.
10. Mars has two moons. It has seasons that are longer than ours. It has a little air and water, it is possible that it may have some living things.
11. Jupiter is the largest and heaviest of the planets. It is surrounded by clouds, is very cold and its gravity is enormous. It has 12 moons.
12. Saturn has nine moons. It revolves once around the sun in about 29 1 2 years and rotates on its axis in about 10 hours.
13. Saturn is very cold, it has plenty of poisonous gas but no oxygen. It differs from all the other planets in that it is surrounded by three broad but thin rings that revolve at different speeds around its equator.
14. Uranus revolves once around the sun in about 84 years and rotates on its axis once in about 10 hours. Unlike the other planets which rotate on an almost vertical axis, Uranus rotates on an almost horizontal axis. It has five moons.
15. scientists call Neptune and Uranus twin planets because both are about the same size. Neptune revolves once around the sun in about 165 years and rotates on its axis once in about 16 hours.

16. it has no oxygen and is very cold under its thick layer of clouds. It has two moons.
17. Pluto is the most recently discovered planet in the solar system. It is about 3,700 miles from the sun and revolves once around the sun in about 248 years. Astronomers do not yet know how long it takes Pluto to rotate once on its axis or how many moons it has, if any.
18. between the orbits of Mars and Jupiter are planetoids or asteroids -- pieces of a big planet that once revolved around the sun between the orbits of Mars and Jupiter.
19. comets are made of gases and small pieces of solids. They revolve around the sun in long, oval-shaped orbits. They reflect the sun's light and can be seen. The tail of a comet always points away from the sun.
20. the period of a comet's revolution does not change and can be used to predict the date of the comet's return.
21. meteoroides are small objects of stone or metal that revolve around the sun. We see them and call them meteors only when they fall into the earth's atmosphere and are heated by friction with the air. Most meteors burn up before they reach the earth making a bright streak of light. The remains of those that hit the earth are called meteorites.

D. To learn that:

1. the pull of the earth is called gravity.
2. gravity is a great force. It pulls everything toward the center of the earth.
3. no matter where we go, "up" is away from the center of the earth and "down" is toward the center of the earth.
4. gravity may be an advantage of disadvantage.
5. the gravity of the earth is believed to extend far out into space.
6. the earth's gravity pulls the moon and helps to keep it circling around the earth.

E. To know that.

1. an eclipse occurs only when the sun, the moon, and the earth lie on a straight line.
2. an eclipse of the moon occurs when the earth comes between the sun and the moon and the shadow of the earth falls on the moon.
3. an eclipse of the sun occurs when the moon comes between the sun and the earth and the shadow of the moon falls on the earth.
4. an eclipse may be total or partial.
5. astronomers can calculate exactly when eclipses will occur, even thousands of years in advance.

F. To learn that:

1. stars are suns. They differ in size. Some are much larger than our sun.
2. all of the stars except the sun are far beyond the solar system. They look smaller than the sun because they are so much farther from us.
3. Some stars seem to be grouped together in constellations.
4. Polaris is a star almost directly over the North pole.
5. scientists measure distances in light-years.
6. a galaxy is a huge group of stars.
7. the solar system is part of a huge group of stars called the Milky Way Galaxy.

Evaluative Techniques and Procedures

Below are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- indicated under each objective are found in the Appendix under Experience Area 3 -- The Earth and Beyond.

1. Objective 1
   (a) Objective tests -- See items I-15; II-A-13, 15. III-B-1, IV-A-1, 2; IV-B-2.

2. Objective 2
   (a) Objective tests -- See items I-2, 5, II-A-1, 2, 4, 10, 11, 12, 13, 15, 16, 17, 18; III-A-1, 3, 5; III-B-1, 2, 5; IV-A-1, 2; IV-B-1, 2, 3.

3. Objective 3
   (a) Objective tests -- See items I-1 through 3, 5 through 14, II-A-1, 2, 4, 6 through 12, 14 through 20, II-B-1, 2; III-A-1 through 5; III-B-1 through 5, III-C; IV-A; IV-B-1 through 3; V-A; V-B-1 through 10; V-C-1, 2; V-D-1 through 4; V-E.
   (b) Essay tests -- See items 2, 3, 4.

4. Objective 4
   (a) Objective tests -- See items I-5, 14; II-A-4; III-A-1, 2, 3, IV-B-3c; V-B-4; V-C-1; IV-D.

5. Objective 5
   (a) Objective tests -- See items I-1, 2, 3, 6, 11, 13; II-A-8, 15, 16, 17; III-A-4; III-B-5, V-B-3; V-C-2.

6. Objective 6
   (a) Objective tests -- See items I-4, 9, 15; II-A-3, 5, 6, 20, II-B-2.

Experience Area 4 - Ways and Means

Unit V - Common Mechanical and Electrical Devices Used in the Home and in Industry: Heat and Light

Problems

A. What is the nature of electricity and how may it be produced?

B. How is electrical energy changed to the energy of heat, light, and motion?

C. What is the importance of electricity to man and his work?

D. What safety precautions must be taken in connection with our use of electricity?

Objectives

A. To know that:

1. all matter is made up of atoms and that atoms differ from one another with regards to the number of protons in a nucleus and the corresponding number of electrons revolving around the nucleus.
2. each proton has a positive electrical charge and each electron has a negative electrical charge.
3. the electrons move freely around the center or nucleus of the atom while the protons are packed closely together with the neutrons in the nucleus.
4. usually atoms are balanced, having the same number of electrons as protons. When an electron is lost by an atom, the atom becomes unbalanced.
5. the nucleus of an atom exerts a strong force of attraction on the electrons surrounding it but less force on the electrons farthest from it.
6. it is possible to remove electrons from the atoms of some material by rubbing the material with certain materials.
7. the material that loses electrons now becomes positively charged while the material that gains electrons now becomes negatively charged.
8. when two positively charged materials are brought close together, they repel each other. The same thing will happen when two negatively charged materials are brought close to each other.
9. when a negatively charged material is brought close to a positively charged material, they will be attracted to each other.
10. materials that are either positively or negatively charged will attract neutral materials (those that have neither lost nor gained electrons).

11. electrons that are transferred to the surface of a material by rubbing and are no longer part of an atom are called static charges of electricity.
12. static electricity or frictional electricity is produced by friction or rubbing.
13. lightning is considered to be a discharge of static electricity.
14. static charges of electricity do not move from one object to another. When charges of electricity move, they are no longer considered static but current electricity.
15. current electricity is a form of energy and therefore can be produced from other forms of energy like:
    (a) chemical energy, using wet cell, dry cell, and storage battery.
    (b) mechanical energy, using the generator and piezoelectric cell.
    (c) light energy, using the photoelectric cell and the solar battery.
    (d) heat energy, using the thermocouple.
16. the speed of the movement of the electrons as well as the number of electrons, determines the strength of the current. The speed of electron movement is measured in amperes.
17. the number of electrons travelling in a circuit depends upon the force that pushes the electrons through a wire or conductor. Increasing the force increases the number of electrons set free to travel in a circuit.
18. some materials allow an electric current to flow through them easily. These materials are called conductors.
19. materials that do not allow an electric current to flow through them easily, if at all, are called nonconductors or insulators.
20. an electric current will flow only through a closed circuit.
21. an electric circuit consists of a source of the current, a conductor to carry the current, and may or may not have a device that uses the current.
22. electric current is controlled by insulating materials, switches, fuses, and transformers.
23. lamps in an electric circuit may be connected either in series, in parallel, or combinations of both.
24. an electric current always takes the shortest available circuit back to its source.

B. To know that:

1. electricity is a very important form of energy. It is used at home, at school, in factories, and other places.
2. electrical energy can be changed to the energy of motion.
    (a) A wire in which an electric current is moving is surrounded by a magnetic field.

  - (b) Many electrical devices which have moving parts are worked by electromagnets.
  - (c) An electromagnet pulls only when an electric current is flowing through it and stops pulling when the electric current stops.
  - (d) An electromagnet can be made stronger in several ways; its poles can be reversed.
- 3. electrical energy can be changed to heat energy.
  - (a) When an electric current flows through a wire, some of the electrical energy is changed to heat energy.
  - (b) Only a very small part of the electrical energy of an electric current flowing through a good conductor is changed to heat energy.
  - (c) Much of the electrical energy of an electric current flowing through a poor conductor is changed to heat energy.
- 4. electrical energy can be changed to light energy.
  - (a) An electric current can make wires so hot that they give off light.
  - (b) An incandescent lamp contains a fine wire called a filament which glows white when it is heated. The hotter the filament in an incandescent lamp, the more electrical energy it changes to light energy.
  - (c) A fluorescent lamp has chemicals inside that glow in the presence of ultra-violet light.
  - (d) In a fluorescent lamp, light is produced by fluorescent chemicals rather than by hot filament.
  - (e) A fluorescent lamp does not change as much of the electrical energy to heat as an incandescent lamp does.
  - (f) Electrical energy can also be changed to light energy by passing an electric current through certain kinds of gas, such as mercury, neon, and sodium.

C. To know that electricity plays an important part in almost everything we use; and in almost every home and factory;

1. We use electricity for light and to run the electric refrigerator, the electric stove, the air conditioner, the electric toaster, the electric iron, and many other things we use in the home.
2. Many machines such as those that prepare and pack our foods, make our clothing materials, print our books and newspapers, make our utensils, equipment and toys are run by electricity.
3. Electricity has improved our means of transportation and communication.

D. To know the following safety rules in connection with electricity:

1. Never touch a bare wire which may be connected to house current or to some other source of high voltage.
2. Never touch wires which you may find dangling from poles after a storm.
3. Disconnect all electrical appliances, especially heating appliances, when they are not being used.
4. Never touch a switch or electrical appliance when your hands are wet.
5. Never put your fingers or any metal object inside an electric socket or outlet.
6. Never touch a switch, electric fixture, radio, or telephone set while the body is in contact with water in the bathtub or washbowl.
7. Never attempt to repair extension cords or household appliances unless you know what you are doing.
8. Do not overload your home circuit by plugging too many appliances in one wall plug.
9. Never poke around the back of a radio or television set when these appliances are turned on.
10. Replace electric cords where the insulation is cracked or worn thin.
11. Do not touch an electric cord with one hand and a water pipe, faucet, or radiator with the other hand.
12. When a fuse burns out always replace the fuse with a new one that will carry the same amount of current. Find out what made it burn out and correct the condition before putting in a new fuse. Never put a penny in the fuse box instead of a new fuse.
13. Do not fly kites in a place where there are many electric wires.

Evaluative Techniques and Procedures

Below are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- indicated under each objective are found in the Appendix under Experience Area 4 -- Ways and Means (Practical, Mechanical, Electrical).

1. Objective 1
    (a) Objective tests -- See item I-A-I through 5, I-B-1 through 5, II-A-1 through 9, 11, 15, 18, 19, 22 through 25, II-D-1 through 7, II-E-1, 3, 4, 5, III-A-1, 2, III-B-1, 2, III-C-1, 2, III-D-1, 2, III-E, III-F, III-H-1, 2, 9, 10; III-I-1, 2.

   (b) Essay tests -- See item 1.

2. Objective 2
   (a) Objective tests -- See items I-B-1, 3, 4, 5; II-A-6, 8, 13, 14, 16, 17, 19, 20, 21, 23, 24, II-B-1 through 8, II-C-1 through 5, II-E-2, 3, 4, 6, II-F-1 through 10; III-A-1, 2, III-C-3 through 5 III-G-2, 3, 4, 5, 6, 7, 8, 9.
   (b) Essay tests -- See items 1, 2, 3, 5.

3. Objective 3
   (a) Objective tests -- See items I-B-3; II-A-14, 20, 23, 25. II-B-1 through 8, II-C-1 through 5, II-E-5, 6, II-F-1 through 10, III-B-1, 2, III-C-3 through 5, III-E; III-F, III-G-3 through 5.
   (b) Essay tests -- See items 2, 3, 5.

4. Objective 4
   (a) Objective tests -- See items III-H-1 through 10.
   (b) Essay tests -- See item 4.

Experience Area 5 - The Human Body and Its Care

Unit VII - Safety First: First Aid

Problems

A. What safety habits will help us avoid common accidents?

B. How can we help make our home, our school, and our playgrounds safe?

C. Why is a thorough knowledge of first-aid treatments important?

D. What are some first-aid treatments which we might apply in case of accidents?

Objectives

A. To know that most accidents are due to carelessness and negligence.

B. To know that most accidents can be prevented by following safety rules and taking necessary precautions such as:

   1. when walking on the street
      (a) cross streets at corners
      (b) cross only on proper signal, watching for turning cars
      (c) look both ways before crossing

    (d) walk, not run
    (e) always use the pedestrian lanes; avoid crossing the street between stopped cars
    (f) obey the safety patrol
    (g) always use the sidewalk, if there is none and you must walk in the roadway, walk on the left, facing traffic
    (h) when walking at night wear or carry something white to help drivers see you.

2. when riding in a moving vehicle
    (a) take your seat carefully
    (b) keep from sticking your arms and head out of the window
    (c) avoid talking to the driver
    (d) do not get off until the vehicle has completely stopped
    (e) look both ways when getting off
3. in school
    (a) walk, not run in halls
    (b) wait for your turn, not push
    (c) walk, not run, on stairs
    (d) know your fire drill
    (e) avoid throwing stones, sand, or any hard object where there is danger of hitting someone
    (f) avoid playing rough games
    (g) keep pencils, crayons, etc. out of your mouth
4. after class is dismissed
    (a) go home right away
    (b) avoid walking on the railroad tracks or sitting on the side of the street
    (c) follow the safety rules for walking or riding a bus home
5. when you play
    (a) play in the yard or play area
    (b) wait for your turn, not push
    (c) avoid playing rough games
    (d) keep from teasing animals; avoid strange animals
    (e) keep from playing with fire
6. when bicycling
    (a) drive close to curb
    (b) obey traffic rules
    (c) refuse handlebar rides
    (d) keep from hitching to autos, buses, jeepneys, etc.
7. when skating
    (a) tie on skates firmly
    (b) skate only on sidewalks
    (c) do not push or pull one another
8. when swimming
    (a) make sure someone is nearby who can help in an emergency
    (b) swim at a safe bathing place, preferably supervised by lifeguards

  - (c) beware of unfamiliar areas since they may have treacherous currents, deep holes, and other hazards
  - (d) don't swim when overheated, overtired, or right after eating
  - (e) before diving, make sure the water is deep enough and has no hidden objects
  - (f) know your own ability; don't overestimate it
- 9. at home
  - (a) put away your things in their proper places
  - (b) walk, not run, on stairs
  - (c) keep from playing with matches
  - (d) put all toys in a box or on shelf after playing with them
  - (e) put matches in metal box
  - (f) keep from playing with firearms
  - (g) keep from reaching for handles of pots on stove
  - (h) keep from touching electrical appliances or fixtures with wet hands or if any part of your body is touching a water pipe
  - (i) pick up pins from floor
  - (j) keep knives, scissors, and other sharp implements in a special storage place, well out of reach of small children
  - (k) do not run while carrying sharp instruments and be careful not to run against glass doors
  - (l) take special care when using knives and other sharp implements; always hand a knife to another person with the point turned away from the recipient
  - (m) make sure that broken glass is swept up promptly
  - (n) use a sturdy ladder or step stool, not a chair, to reach high places; do not overreach
  - (o) put out fires before leaving
  - (p) disconnect all electric appliances when they are not used

C. To know that we can make our home, our school, and our play grounds safe by:

1. inspecting steps, handrails, floors regularly to make sure they are in good condition and making necessary repairs promptly
2. keeping steps and hallways clear
3. providing adequate light, especially on stairs
4. wiping up spilled grease or water immediately
5. installing fire extinguishers in danger spots and having a section of garden hose near a faucet for use in case of fire
6. checking electric wiring of homes regularly lest it be defective
7. not allowing trash to accumulate anywhere in the house
8. not using flammable cleaning fluids

    9. storing flammable materials safely
    10. not hanging clothes or curtains in places where they may blow into or near flames
    11. not placing electric cords under rugs or in places where they may be walked upon
    12. replacing cords that are frayed without delay
    13. not overloading the electric circuit
    14. not repairing electrical appliances or fixtures unless we are thoroughly familiar with them
    15. replacing immediately defective electrical or gas appliances or devices
    16. reporting immediately cases of leaks in a gas supply
    17. not using open gas burners in small, unventilated rooms
    18. keeping all medicines, household cleansers, disinfectants, exterminators, and other materials well out of the reach of young children
    19. keeping all bottles labeled and always carefully reading labels before taking or applying medicine
    20. keeping poisonous drugs away from other medicine preferably locked in a separate storage place; labeling poisons with large lettering and discarding them when their purposes have been served
    21. disposing promptly prescription drugs that have not been completely used
    22. inspecting playground apparatus regularly and making needed repairs promptly
    23. keeping grounds free from pieces of broken glasses, tin cans, pieces of sticks, pins, and other sharp metals
    24. putting away in safe places laboratory equipment and supplies

D. To know that a thorough knowledge of first aid treatments is important because it.

    1. enables us to assist victims of accidents or sudden illnesses wisely
    2. enables us to give proper immediate care to our own injuries or to direct others toward proper care of our own injuries
    3. fosters forcefully the safety consciousness that we all need
    4. is a civic responsibility

E. To learn the following first aid treatments (76, p.11).

    1. stopping a nosebleed
        (a) Ask person to sit with head thrown back or to lie down with head or shoulders raised.
        (b) Pack the bleeding nostril lightly and then pinch near the tip of the nose.
        (c) Maintaining pressure with a small amount of gauze for several minutes may be necessary or applying cold wet towels to the face sometimes stops the bleeding.

2. treating minor scratches or bruises
    - (a) Cleanse the injury thoroughly using clean running tap water and soap, applying the soap and water with a sterile dressing.
    - (b) Apply a dry sterile dressing and bandage it snugly into place.
    - (c) See your school nurse or school doctor promptly if evidence of infection appears.
3. stopping slight bleeding (on the finger, on the arm, or on the toes)
    - (a) Apply pressure directly over the wound with a sterile or clean cloth.
    - (b) In some cases pressure can be applied against the supplying vessel: (1) pressure on the inner half of the arm, midway between the elbow and the armpit diminishes bleeding in upper extremity below the point of pressure, (2) pressure applied just below the groin on the front, inner half of the thigh, diminishes bleeding in the extremity below the point of pressure.
    - (c) Bandage firmly into place the cloths used in controlling hemorrhage.
    - (d) If extremity is involved, elevate it, using pillows or substitutes.
4. reviving someone who has fainted
    - (a) Put the patient on his back and keep him recumbent until recovery is complete for perhaps 10 minutes or more.
    - (b) Apply a whiff from an ammonia bottle to the person's nostrils
5. treating animal bites
    - (a) Wash wound thoroughly to remove saliva. Use a gauze compress and a solution of soap and water to scrub the wound, then rinse it with clean running water and apply a sterile dressing.
    - (b) Consult a physician at once for medical attention and if necessary for immunization treatments.
6. removing a foreign body in the eye
    - (a) Pull down the lower lid and see if the body lies on the surface of the lid's lining. If so, lift it off gently with the corner of a clean handkerchief or a piece of moist cotton wrapped around a clean toothpick (never use dry cotton around the eye).
    - (b) Grasp the lashes of the upper lid gently between the thumb and forefinger while the victim looks upward. Pull the upper lid forward and down over the lower eyelid. A foreign body on the lining of the upper lid can be dislodged and swept away with the tears.
    - (c) Flush the eye with a solution of boric acid (1/2 teaspoon to a glass of boiled water). This can be done with an eye dropper.

7. preventing infection of wounds
    - (a) Keep wounds well covered and bandaged after treatment.
    - (b) Avoid wetting the wound as much as possible.
    - (c) Consult your school doctor regularly if medical attention is needed.
8. easing a sprain
    - (a) If there is any possibility of fracture, immobilize the part, otherwise elevate the joint upon pillows or substitute.
    - (b) Cold, wet applications or an ice bag during the first hour after the injury may retard the swelling.
    - (c) Keep the joint quiet. Do not walk on a sprained ankle until it has a protective support.
    - (d) Always have sprains X-rayed.
9. easing a fracture
    - (a) Obtain medical attention promptly, meanwhile, keep the broken ends and the adjacent joints quiet.
    - (b) If the fracture is compound, apply a sterile dressing to the wound. Control hemorrhage by direct pressure.
    - (c) Do not push a protruding bone back. If splinting and transportation is necessary, the end will slip back when the limb is straightened for splinting.
    - (d) An ice bag over the painful area will limit and reduce swelling and pain.
10. helping a person whose clothes are afire
    - (a) Immediately wrap in a blanket the person whose clothes are afire
    - (b) Roll on the ground if your own clothes catch fire.
    - (c) Water, if available, can be used to put out the fire.
11. reviving a drowned person
    - (a) If there is foreign matter visible in the mouth, wipe it out quickly with your fingers or a cloth wrapped around your fingers. Tilt the head back so the chin is pointing upward. Pull or push the jaw into a jutting-out position.
    - (b) Open your mouth wide and place it tightly over the victim's mouth. At the same time pinch the victim's nostrils shut or close the nostrils with your cheek. Blow into the victim's mouth. (Air may be blown through the victim's teeth, even though they may be clenched). The first blowing efforts should determine whether or not obstruction exists.
    - (c) Remove your mouth, turn your head to the side, and listen for the return rush of air that indicates air exchange. Repeat the blowing effort. For an adult, blow vigorously at the rate of about 12 breaths per minute. For a child, take relatively shallow breaths appropriate for the child's size, at the rate of about 20 per minute.

(d) If you are not getting air exchange, recheck the head and jaw position. If you still do not get air exchange, quickly turn the victim on his side and administer several sharp blows between the shoulder blades in the hope of dislodging foreign matter. Again sweep your fingers through the victim's mouth to remove foreign matter.

Those who do not wish to come in contact with the person may hold a cloth over the victim's mouth and breathe through it. The cloth does not greatly affect the exchange of air.

Evaluative Techniques and Procedures

Below are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- performance tests, and non-testing devices indicated under each objective are found in the Appendix under the experience area -- The Human Body and Its Care.

1. Objective 1
   (a) Objective tests — See items III-C-1-a through j; III-C-3-a through j; 1 through t; III-F-2-g; III-F-3-e.
   (b) Essay tests -- See items 1-c, 5-c.
   (c) Non-testing procedures -- See items IV-A-2-a through r, V-A-1-a through e, V-A-2-a through o, VI-A-1-a through f.

2. Objective 2
   (a) Objective tests -- See items III-C-1-e, f, g, j. III-C-3-g, i, k, p, q, r, t.
   (b) Essay tests -- See item 3-c.
   (c) Non-testing procedures -- See items V-A-1-a through e; V-A-2-a through o; VI-A-1-a through f.

3. Objective 3
   (a) Objective tests — See items II-B-1-h, i, j; 12.
   (b) Essay tests -- See items 2-c.

4. Objective 4
   (a) Objective tests — See items II-A-26, 28, II-G-1 through 5; III-C-3-a, h.
   (b) Essay tests -- See items 5-b, 5-c, 7-c.
   (c) Performance tests -- See items 1 through 5.

Unit VIII - The Right Kinds of Food: Their Selection and Preparation

Problems

A. Why does the body need food?

B. What materials do we get from food? How does the body make use of these materials?

C. What is a balanced diet? What is the importance of eating a balanced diet each meal?

D. What should be considered in the preparation of a day's menu?

E. Why is it important to eat only clean foods?

F. Why is water important to the body? How does the body get water? How can we make water safe to drink?

Objectives

A. To know that the body needs food to live and grow. Food provides materials that:

1. give the body energy.
2. repair and build tissues.
3. help regulate the activities of the body.

B. To learn that:

1. the necessary food materials can be divided into six main classes: carbohydrates, fats, proteins, minerals, vitamins, and water.
2. a person should eat different kinds of food to make sure that the body is getting all these necessary food materials.
3. carbohydrates supply the body heat and energy for movement. Carbohydrates include sugars and starches.
4. fats also supply the body energy. Fats produce twice as much energy as carbohydrates.
5. when a person eats more carbohydrates than his body needs, the extra carbohydrates are changed into fat and stored in the body.
6. proteins repair and build muscles and other tissues. Children especially need proteins for growing.
7. minerals are important for body growth, for the repair of body tissues, and for regulating some activities of the body.

(a) Calcium and phosphorus are needed to make the bones and teeth strong.
(b) Iron is present in the chemical that makes the blood red.
(c) Iodine is present in the thyroid gland and helps to regulate the burning of the food in the body.

8. Vitamins control and regulate certain activities in the body and are important for body growth. Without vitamins the body develops certain diseases called deficiency diseases.
    (a) Vitamin A keeps the lining of the nose, throat, and eyelids healthy. Lack of vitamin A causes serious eye disease that may result in night blindness. Lack of it also cuts down the body's resistance to colds and other infections.
    (b) Vitamin B_1 (also called thiamin) helps control the digestion and use of carbohydrates in the body. Lack of vitamin B_1 causes loss of appetite, poor digestion, headaches, tiredness, and irritability. A severe lack of it causes a serious nervous disease called beriberi.
    (c) Vitamin B_2 (also called riboflavin) helps the cells in the body function properly. It is needed to keep the skin healthy and to help control the digestion and the use of carbohydrates in the body. Lack of vitamin B_2 causes stunted growth, a disease of the mouth where the lips and tongue become cracked, and a scaly skin disease.
    (d) Vitamin-niacin helps the digestive and nervous systems function properly, and is needed for the digestion and use of carbohydrates in the body. Lack of niacin causes a disease called pellagra, which produces skin rashes, a smooth tongue, digestive disturbances, mental disturbances, and paralysis.
    (e) Vitamin C (also called ascorbic acid) regulates the use of calcium and phosphorus in the body and helps build and maintain healthy teeth and gums. Lack of vitamin C produces sore gums, soft teeth, and weak blood vessels. A severe lack of it causes a disease called scurvy, which produces bleeding gums, a swollen tongue, a tendency to bruise easily, bleeding around the bones, and sometimes teeth falling out.
    (f) Vitamin D regulates the use of calcium and phosphorus in the body and helps build and maintain strong bones and teeth. Lack of vitamin D produces soft bones and poor teeth, a disease called rickets where the bones grow out of shape and "bow legs" or "knock knees" are formed. The skin can make vitamin D when it is exposed to the ultraviolet rays of the sun.

(g) Vitamin K helps the blood clot. It is used in blood injuries and in surgical operations to prevent loss of blood.

C. To know that a balanced diet contains the different food substances in the right proportions. It includes food which contain fuel, proteins, vitamins, and minerals. It is important that we eat balanced diets because:

1. there are several factors to be considered in the preparation of a day's menu. Some of these are:
    (a) the age of the persons for which the menu is prepared — younger persons use more energy and proteins than older persons.
    (b) the type of activity they mostly do -- active persons need more energy than quiet persons.
    (c) size -- larger persons need more energy, proteins, minerals, and vitamins than smaller persons.
    (d) sex -- males usually use up more energy than females.
    (e) body constitution -- some bodies use up food materials more quickly than other bodies. Sick people need more of a certain food material than healthy people.
2. every bit of food produces a certain amount of energy which is measured in units called calories. Some foods are richer in calories than other foods.
    (a) If a person takes in more food calories a day than his body can use, the extra food material is stored in the body as fat, and the person gains weight.
    (b) If a person takes in less food calories a day than his body needs, the body now uses the stored fat, and the person loses weight.
3. A day's meal must include the four basic food groups to keep the body healthy. The basic food groups are:
    (a) the milk group -- includes milk, butter, cheese, and ice cream.
    (b) the meat group -- includes meat, chicken, fish, eggs, beans, peas, and nuts.
    (c) the bread-cereal group -- includes whole-grain or enriched bread and cereals, spaghetti, and macaroni.
    (d) not all attractively prepared foods are valuable for body growth. We can prepare simple but properly balanced meals.

E. To know that the foods we eat must be clean. Foods that are not clean may have bacteria that cause disease.

F. To know that.

1. water is very important to the body.

    - (a) A person will die more quickly from lack of water than from lack of food.
    - (b) All cells in the body need water to function properly.
        - (1) The body needs water to digest the food, absorb it, carry it to all parts of the body.
        - (2) The body needs water to get rid of the waste materials that are formed.
2. the body gets water in three ways.
    - (a) Most of the foods have water in them.
    - (b) Some water is formed when the food is burned in the body.
    - (c) Water is taken into the body as drinking water or as milk and other liquids.
3. drinking water need not be boiled when we are sure that the source is safe and clean. Water may be made safe to drink by boiling, aeration, or the use of water-purifying chemicals.

Evaluative Techniques and Procedures

Below are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- and non-testing devices indicated under each objective are found in the Appendix under the experience area -- The Human Body and Its Care.

1. Objective 1
    - (a) Objective tests -- See items II-A-3; II-B-1-a through g, II-C-3-a, b, d, e, f, g, h, II-C-4-b, II-E-2-a, g.
    - (b) Essay tests -- See items I-b, 3-a; 4-a; 6, 8, 10.
    - (c) Non-testing procedures -- See items I-3, 7, II-2; VI-A-2-a through g.

2. Objective 2
    - (a) Objective tests -- See items I-15; II-A-2, 7, 8, 9, 10, 12, 13, 25; II-B-1-a through g, II-C-3-a, b, d, e, f, g, h, II-C-4-b, III-E-1; III-E-2-a, g; II-F-3 through 6; II-F-3-h, i, II-F-4.
    - (b) Essay tests -- See items 1-b; 3-a; 6; 7-a; 8; 10.
    - (c) Non-testing procedures -- See items II-2, III-C-1 through 20; VI-A-2-a through g.

3. Objective 3
    - (a) Objective tests -- See items I-6; II-A-2, 3, 8, 10, 25, II-B-1; II-C-3-a, b, d, e, f, g, h; II-C-4-b; II-E-1, II-E-2-a, g; II-F-1 through 10, III-F-c, e, f; III-F-3-h, i; III-F-4.

(b) Essay tests -- See items 3-a; 6; 7-a; 8; 10.
(c) Non-testing procedures -- See items II-2; III-C-1 through 20.

4. Objective 4
    (a) Objective tests -- See items II-A-2, 3, 8; II-B-1-a through g, II-F-1 through 10; III-F-1-e, f; III-f-3-h.
    (b) Essay tests -- See items 6; 7-a; 8-a; 10.
    (c) Non-testing procedures — See items III-C-1 through 20.

5. Objective 5
    (a) Objective tests -- See items III-F-1, 2, 3, 8, 9.
    (b) Essay tests -- See item 8.
    (c) Non-testing procedures -- See items II-1, 3.

6. Objective 6
    (a) Objective tests -- See items II-A-7, 11.
    (b) Essay tests -- See item 2-b.
    (c) Non-testing procedures -- See items I-11.

Unit IX - Body Structure and Growth

Problems

A. What are the different parts, organs, and systems of the human body?

B. How do these parts, organs, and systems of the body perform their work?

C. How can we keep them in good working condition?

D. In what ways can we maintain or improve our health through temperance?

Objectives

A. To learn that the human body has many parts that work together to make it function.
    1. The human body is made up of millions of tiny cells which differ in size and shape. Each special kind of cells carry on a special kind of work. Examples of special kinds of cells include blood, muscle, skin, nerve, and bone cells.
    2. A group of the same kind of cells that carry on the same work is called a tissue. The five main kinds of tissue in the human body are the muscle tissue, the nerve tissue, the skin tissue, the connective tissue, and blood (even though it is a liquid).

3. A group of different tissues all working together is called an organ. An organ carries out a special activity or group of activities in the body. Examples of organs include the heart, lungs, liver, stomach, eyes, ears, and brain.
4. A group of organs working together on a special body activity is called a system. There are different systems in the human body. They include the skeletal system, the muscular system, the digestive system, the circulatory system, the respiratory system, the excretory system, the nervous system, and the endocrine system.

B. To learn that:

1. the skeletal system supports the body, gives the body its shape and protects the delicate organs in the body.
2. bones are hard and firm but their connections are flexible.
3. cartilage helps keep bones from grinding together when they move.
4. bones are held together by ligaments. The places where parts of the skeleton come together are called joints. There are several kinds of joints, including hinge and ball-and-socket joint.
   (a) A hinge joint allows the part to move back and forth.
   (b) A ball-and-socket joint allows the part to rotate and move in many directions.
5. muscles are attached to bones and enable the body to move. There are two kinds of muscles voluntary and involuntary.
   (a) Voluntary muscles are muscles we can control — they move whenever we want them to move.
   (b) Involuntary muscles are muscles that we cannot control— they move food through the digestive system, blood through the body and control breathing. The heart muscle is an involuntary muscle.
6. a muscle works by shortening or contracting.
7. muscles get firmer and stronger with exercise.
8. food must be digested before it can be used by the body. Digestion consists of breaking down foods into simpler materials and changing them to a liquid.
   (a) The teeth cut and grind food into small bits. While the food is being chewed, it is mixed with saliva. Saliva moistens and softens the food, making it easy to swallow. It contains an enzyme that changes starch into sugar.
   (b) The tongue helps in chewing and swallowing the food to the back of the mouth down the throat and esophagus into the stomach.
   (c) Muscles in the walls of the stomach and intestines help move food and mix it with digestive juices. Digestive juices, added to food in various parts of the digestive system, help change it to usable form.

   (d) Digested food materials pass into the blood through the walls of the small intestine.
   (e) Indigestible material continues through the large intestine and out of the body.

9. the circulatory system carries digested food to the cells in the body; brings oxygen to the cells for burning the food and producing heat and energy; takes away the waste materials produced by the cells and carries these materials to organs that remove them from the body.

10. the circulatory system is made up of the heart, blood, and blood vessels.
   (a) The heart pumps blood through the circulatory system of the body.
   (b) The arteries carry blood from the heart to the body tissues.
   (c) The veins carry blood back to the heart.
   (d) Capillaries are very tiny blood vessels between the smallest arteries and the smallest veins.
   (e) The blood carries food materials to the cells and waste materials from the cells, these materials passing through the extremely thin walls of the capillaries.
   (f) Blood is the transportation system of the body; it carries digested food from the intestines to the body cells. It carries oxygen from the lungs to the rest of the body, and it brings to the lungs for removal the waste product, carbon dioxide.
   (g) The blood contains red cells, white cells, platelets, and plasma.
      (1) The red cells or red corpuscles contain hemoglobin which gives them their red color. They pick up oxygen from the lungs and carry it to the cells in the body. The cells use the oxygen to burn food and carbon dioxide is produced as a waste material. The red corpuscles pick up the carbon dioxide and carry it to the lungs, where the carbon dioxide is given off.
      (2) The white cells or white corpuscles destroy bacteria and other disease germs.
      (3) Plasma is mostly water and contains salts, fibrinogen (special protein), antibodies, hormones, and carries the red cells, white cells, and platelets.

11. the work of the respiratory system is to bring oxygen into the body and to get rid of carbon dioxide.
   (a) The parts of the respiratory system include the nose, the throat or pharynx, the voice box or larynx, the windpipe or trachea, and the bronchi which enter the lungs. In the lungs the bronchi divide into the bronchial tubes which branch into bronchials which expand into clusters of air cells known as alvioli or air sacs.

(b) Oxygen must combine with food materials before they can supply energy.

(c) The air that we breathe in provides oxygen. It flows through the nostrils where it is warmed and filtered of the dust and other materials it may contain.

(d) The air passes through the nasal passages to the throat and down to the windpipe which branches into two tubes each going to one of the two lungs. The bronchial tubes keep branching into smaller and smaller tubes until the smallest tubes end in clusters of little air sacs. The air sacs in the lungs are surrounded by millions of capillaries.

(e) Oxygen passes through the thin walls of the air sacs and into the capillaries that surround the air sacs. Red blood cells pick up the oxygen and take it to the heart, which pumps blood through the arteries and capillaries to every part of the body.

(f) The cells of the body take the oxygen and use it to burn the digested food, producing heat and energy and giving off carbon dioxide.

(g) Red blood cells pick up the carbon dioxide and return to the heart. The heart sends the blood containing the carbon dioxide to the lungs. The air containing carbon dioxide is forced out of the lungs and fresh air containing oxygen is forced into the lungs.

12. the removal of waste materials from the body is called excretion.

    (a) The human body produces many different kinds of waste materials -- carbon dioxide, excess water, mineral salts, digestive juices left behind after digestion, and undigested and unused food.

    (b) The body gets rid of waste materials in different ways:

        (1) The lungs give off carbon dioxide and some excess water in the form of water vapor.

        (2) The skin gives off perspiration, which contains water and dissolved mineral salts.

        (3) The kidneys, which are two dark red, bean-shaped organs located in the lower part of the back, remove from the blood such waste materials as mineral salts and protein compounds. The wastes, together with excess water, form a liquid called urine. The urine flows from the kidneys to a storage organ called the bladder.

    (c) The undigested and unused food, together with used digestive juices, pass through the large intestine and out of the body as feces.

13. the nervous system controls the action of the muscles and organs. It controls thinking, learning, memory, and sensations such as smell, taste, touch, pressure, sight, hearing, heat, cold, and pain.

- (a) The three main parts of the nervous system are the brain, the spinal cord, and the nerves.
- (b) The brain, located inside the skull, is the control center of the body. It receives messages from all parts of the body and sends out orders in return. It has three main parts -- the cerebrum, the cerebellum, and the medulla.
  - (1) The cerebrum controls thinking, reasoning, learning, memory, and imagination. It receives messages from the sense organs and controls the voluntary movement of the muscles in the body.
  - (2) The cerebellum coordinates the movements of the muscles so that they operate together smoothly, as in walking. It also helps the body keep its sense of balance.
  - (3) The medulla controls the operation of the involuntary muscles in the body such as heart action, breathing, digestion, coughing, and sneezing.
- (c) The spinal cord connects the brain with the rest of the body. It consists of hundreds of nerves and is the main cable of the nervous system.
- (d) Nerves carry messages to and from various parts of the body. Some nerves carry information from sense organs located in various parts of the body to the brain. Other nerves carry messages from the brain to parts of the body.

14. glands are organs whose cells give off juices that have special uses in the body. There are two kinds of glands: glands with ducts and glands without ducts.
    - (a) Glands with ducts (tubes) are called duct glands. Examples of duct glands are the salivary glands in the mouth and the sweat and oil glands in the skin. Digestive juices that help digest food in the body are given off by duct glands in the stomach, the intestine, the pancreas, and the liver.
    - (b) Glands without ducts are called ductless glands or endocrine glands. They give off juices containing chemicals called hormones. The hormones regulate the body activities. The common ductless or endocrine glands include the pituitary gland, the thyroid gland, the parathyroid glands, the islands of Langerhans in the pancreas, and the adrenal glands.
      - (1) The pituitary gland gives off hormones that affect the activity of the kidneys, blood vessels, and milk-producing glands and regulates the growth of the skeleton and the body.
        - (a) If the pituitary gland is overactive during childhood the child will grow up to be a giant.

(b) if the pituitary gland is underactive during childhood, the child will become a midget.

(2) The thyroid gland is located below the voice box on the windpipe. It gives off a hormone which controls the speed or rate at which the body burns and uses food.

(a) A lack of iodine in the diet will make the thyroid gland swell and the throat bulge out to form a goiter.

(b) If the thyroid gland is overactive, the person will become restless, nervous, and easily excited. His heart will beat faster, his hands may shake, and he will not get fat although he eats a lot.

(c) If the thyroid gland is not active enough a person will not have any energy. He will still gain weight although he may not eat much.

(3) The parathyroid glands are located at the back of the thyroid gland. They give off a hormone which controls the use of calcium in the body. Too much of this hormone in the body makes the bones soft. Too little of this hormone in the body causes painful muscle cramps.

(4) The pancreas is both a duct gland and a ductless gland and is located just behind the stomach. Scattered throughout the pancreas are small groups of cells called the Islands of Langerhans which give off a hormone called insulin.

(a) Insulin regulates the use and storage of sugar in the body.

(b) When the pancreas does not produce enough insulin, a person develops a sickness called diabetes. The liver cannot now store the sugar and the cells, tissues, and muscles cannot get the sugar they need. The blood becomes flooded with sugar and excess sugar in the blood passes out through the urine. The person loses weight.

(5) The adrenal glands are located on top of the kidneys. They give off a hormone called adrenalin.

(a) When a person becomes angry or frightened, the adrenal glands pour large amounts of adrenalin into the blood.

(b) The adrenalin makes the heart beat faster, blood pressure rise, breathing becomes faster and deeper, digestion slows down, and causes the liver to send more of its stored sugar to the blood.

        (c) Adrenalin makes blood clot more easily and quickly. When doctors are afraid the heart may stop beating, they give the patient adrenalin.

15. all sensations come from five sense organs, the skin, nose, tongue, eyes, and ears.
    - (a) The sensory nerves in the skin produce the sensations of touch, pressure, heat, cold, and pain.
    - (b) The sensory nerves are not spread out evenly over the skin. The nerve endings sensitive to touch are very near the surface of the skin but the nerve endings sensitive to pressure are located deeper inside the skin.
    - (c) The sense of smell is located in the nose.
        - (1) When the nose smells the same odor for a long time, the nerve endings become deadened to that particular odor so that there is no more sensation of smell for that odor.
        - (2) Man's sense of smell is poor compared to many animals.
    - (d) The sensation of taste is located in the taste buds that are spread over the tongue.
        - (1) The taste buds at the tip of the tongue are sensitive to sweet and salty flavors.
        - (2) The taste buds along the sides of the tongue are sensitive to sour flavors.
        - (3) The taste buds at the back of the tongue are sensitive to bitter flavors.
    - (e) The sense of sight is located in the eye.
        - (1) The eyelids protect the front of the eye.
        - (2) The complete eye which is shaped like a ball is called the eyeball.
        - (3) The eyeball has a tight, white cover around it. A part of this cover, called cornea, is transparent so that light can pass through it. The cornea covers a dark opening in the eye called the pupil.
        - (4) The colored circle around the pupil is called the iris. The iris controls the amount of light that enters the eyeball.
            - (a) When the light is bright, the iris becomes bigger, which makes the pupil smaller, and cuts down the amount of light entering the eyeball.
            - (b) When the light is dim, the iris becomes narrow, which makes the pupil larger, and allows more light to enter the eyeball.
        - (5) Inside the eyeball is a convex lens, which bends the rays of light as they enter the eyeball and makes the rays of light come together.

- (6) At the back of the eyeball is a sensitive lining called retina where the bent rays of light are focused. When light strikes the retina, tiny nerves send impulses (messages) through the optic nerve to the brain, where we experience the sensation of sight.
- (7) Many persons suffer defects of the eye, and cannot see properly.
  - (a) Four common defects of the eye are: nearsightedness, farsightedness, astigmatism, and color blindness.
    - i) In nearsightedness nearby objects can be seen clearly, but distant objects seem blurred.
    - ii) In farsightedness distant objects can be seen clearly, but nearby objects seem blurred.
    - iii) In astigmatism, lines running in one direction may seem clear, but lines running in another direction may seem blurred.
    - iv) In color blindness, the eye is unable to recognize colors, especially red and green.
  - (b) All these defects except color blindness can be corrected with the help of eye glasses.

- (f) The sense of hearing is located in the ear.
  - (1) There are three parts to the ear: the outer ear, the middle ear, and the inner ear.
    - (a) The outer ear collects the sound waves and sends them through a tube to the middle ear. At the end of the tube is the eardrum which vibrates when sound waves strike it.
      - i) The higher the sounds, the faster the eardrum will vibrate.
      - ii) The louder the sounds, the more strongly the eardrum will vibrate.
    - (b) The middle ear passes the vibrations of the eardrum to the inner ear
      - i) The middle ear has three small bones called the hammer, anvil, and stirrup.
      - ii) As the eardrum vibrates the three bones vibrate and make the membrane of the inner ear vibrate.
    - (c) In the inner ear are thousands of nerve endings. When the membrane of the inner ear vibrates, the nerve endings receive the vibrations and send nerve impulses (messages) to the auditory nerve.

        - (d) The auditory nerve carries these nerve impulses to the brain, where we get the sensation of sound.
    - (2) The ear contains the semi-circular canals which help to control our sense of balance.

C. To know that the different systems, organs, and body parts must be well taken care of to keep the body in good running condition.

1. Regular visits to the doctor are important to keep the body in good health.
2. Food is important for energy, growth, and repair of the cells of the body. The foods we eat and the way our body uses them affects the condition of our bones, muscles, nerves, blood, glands, and other body parts.
3. The foods we eat and the water we drink must be free from harmful organisms that will make our bodies ill.
4. Exercise, rest, and sleep are needed to keep the body healthy.
5. Keeping the body clean is important to good health.
6. Good feelings help us toward good health.
7. A clean and pleasant environment is important to maintain good health.
8. Practicing good health habits such as sitting, standing, walking erect, having a regular time to go to bed, not eating between meals, having regular toilet habits, etc., will keep the body healthy.

D. To know that temperance promotes good health.

1. Overeating and strenuous work and exercise are not conducive to good health.
2. Unhappy feelings may result in a loss of appetite, a loss of weight, or the habit of overeating.
3. Drinking and smoking may lead to evil deeds and ill health.

Evaluative Techniques and Procedures

The following are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- and non-testing procedures indicated under each objective are found in the Appendix under the experience area -- The Human Body and Its Care.

1. Objective 1
    - (a) Objective tests -- See items I-10, 12, 13. II-A-1, 5, 14, 18, 21, 22. II-B-1-f, g, II-B-2, 3, 4, 6, 7, 8. II-C-1-g through k; II-H-1-a through f, II-H-3-c, e, III-A-1 through 6.
    - (b) Essay tests -- See items 4-a, 7-b.

2. Objective 2
    - (a) Objective tests -- See items I-9 through 11, II-A-4, 6, 15 through 22, 24, II-B-5 through 8, II-C-1-a through f; III-C-4-a, c, f, g; II-D-1 through 7, II-E-3-a through m; II-H-2-a through e; II-H-3-a, b, d.
    - (b) Essay tests -- See items 3-b; 4-a, 7-b, 8-b, 9.

3. Objective 3
    - (a) Objective tests -- See items I-8, II-A-3, 7 through 12, II-B-1-b, II-C-3-a through h, III-C-4-b, d, e; II-E-2-a through g; III-F-3-a through j. III-F-4.
    - (b) Essay tests -- See items 1-b, d; 2-b, 3-a, c, 8-a, b, c.
    - (c) Non-testing procedures -- See items I, II, III-A, B, VI-A-3.

4. Objective 4
    - (a) Objective tests -- See items I-15; III-F-3-a through j.
    - (b) Essay tests -- See item 1-d.
    - (c) Non-testing procedures -- See items I; VI-A-3.

Unit X - Communicable Diseases and Other Illnesses Affecting the Different Organs of the Body

Problems

A. What are communicable diseases and how can we control and prevent them?

B. What other kinds of illnesses aside from communicable diseases affect the different organs of the body?

C. What are some erroneous beliefs and practices about illnesses?

D. What local plants have medical values?

E. What are some of the modern "wonder" drugs and when should they be used?

Objectives

A. To learn:

1. that communicable diseases are caused by germs which are transferred from one person to another; from animal to man, or from man to animal to man.
2. that common cold, chicken pox, conjunctivitis, diphtheria, measles, influenza, mumps, smallpox, typhoid fever, whooping cough, and tuberculosis are some common communicable diseases.
3. the signs and symptoms, methods of transmission, and ways of controlling and preventing communicable diseases.
    - (a) Common cold
        - (1) Signs and symptoms -- irritated nasal passages and sinuses, watering eyes, chilliness and feeling of weakness.
        - (2) Transmission -- through direct contact, or indirectly by droplet from nose or throat and articles soiled by the discharge of the infected person.
        - (3) Control and prevention -- isolation of infected person, washing and sterilizing eating and drinking utensils, and education in personal hygiene. Prevention by building body resistance, rest, and avoiding undue hot or cold exposure.
    - (b) Chicken pox
        - (1) Signs and symptoms -- usually begins with a mild fever followed several days later by the occurrence of small raised pimples which become filled with a clear fluid, scabs form later.
        - (2) Transmission -- through direct contact, droplets through articles freshly soiled by discharges from skin and mouth of infected persons.
        - (3) Control and prevention -- isolation of infected person. No preventive immunization is known.
    - (c) Conjunctivitis
        - (1) Signs and symptoms -- watering, irritation and redness, of one or both eyes, followed by swelling of lids, and pus in the eye.
        - (2) Transmission -- contact with infected individuals through contaminated fingers, clothing or other articles. It may be transmitted by gnats or flies.
        - (3) Control and prevention -- includes personal cleanliness, hygiene, and treatment of infected eyes.
    - (d) Diphtheria
        - (1) Signs and symptoms -- fever, sore throat and, at times, white or gray patches on the throat, palate, or tonsils. Skin lesions and sores, especially around the mouth.
        - (2) Transmission -- contact with a patient or carrier, or with articles soiled by discharges of such persons. Milk has also served as a mode of transmission.

(3) Control and prevention -- isolation of the patient until he has had antibiotics for a week and three consecutive bacteriologic examinations and found to be free of the diphtheria germ. Adequate immunization at an early age will prevent the disease.

(e) Measles

(1) Signs and symptoms -- moderate to severe cough, red, watery eyes, discharge from the nose, and fever. Usual rash after four to five days.

(2) Transmission -- droplets from nose or throat and direct contact with an infected person or through articles soiled by discharge from nose and throat of an infected person.

(3) Control and prevention -- isolation of the patient from the time of the first symptom until four to five days following the onset of the rash. An effective vaccine is available for preventive immunization.

(f) Influenza

(1) Signs and symptoms -- abrupt onset with fever, chilliness or chills, aches or pains in the back, legs and shoulders, physical discomfort or exhaustion. Nasal discharge, sore throat, and nonproductive cough.

(2) Transmission -- by direct contact, through droplet infection, or by articles freshly soiled with discharges of the nose and throat of infected person.

(3) Control and prevention -- active immunization prior to an outbreak, educate public as to hazards arising from spitting, sneezing, and coughing in the presence of others and the risk in the common use of drinking glasses, towels, eating utensils or toilet articles. Use of and proper disposal of paper handkerchiefs may prevent disease.

(g) Mumps

(1) Signs and symptoms -- begins with slight fever, nausea; then painful swelling at the angle of the jaw and in front of the ear.

(2) Transmission -- droplet spread and direct contact with an infected person; or indirectly through articles freshly soiled with saliva of such persons.

(3) Control and prevention -- isolation of the patient until all swelling disappears. Active immunization is available but is not recommended for use in healthy children. Thorough cleaning and disinfection of articles soiled with secretion from the nose and throat of the patient.

(h) Smallpox

(1) Signs and symptoms -- sudden onset with fever, chills, headaches, severe backache and prostration, continuing for three to four days. The temperature then falls and a rash appears which later forms crust and finally scabs. The scabs fall off at about the end of the third week.

(2) Transmission -- contact with persons who have the disease. Aerial transmission through droplets may occur over short distances within closed spaces. It is spread also by contaminated articles or even persons who have been in close contact with cases.

(3) Control and prevention -- patients should be isolated until all scabs have been shed. All persons who have been exposed to the patient must be promptly vaccinated or revaccinated and observed for three weeks. If fever appears, quarantine until diagnosis is made. All unvaccinated persons in the vicinity of cases should be promptly vaccinated.

Children should be vaccinated at six to twelve months of age. All persons should be revaccinated every three to five years or whenever there is an epidemic.

(i) Typhoid fever

(1) Signs and symptoms -- continued fever, involvement of glands, rose spots on the trunk, and constipation (sometimes diarrhea).

(2) Transmission -- direct or indirect contact with sick patients or well carriers. The principal vehicles of spread are contaminated water and food. Raw fruits and vegetables, milk products, shellfish, and contamination from the unclean hands of carriers is a common method of spread. Flies may be also important vectors.

(3) Control and prevention -- typhoid fever cases should be examined and restricted from food handling. Adequate control depends upon a protected and treated water supply and the sanitary disposal of human excreta. Good personal hygiene by everyone is particularly necessary. Immunization for establishing artificial immunity with periodic boosters is a preventive measure.

(j) Whooping cough

(1) Signs and symptoms -- starts with sneezing and coughing, the coughing increases in severity until a definite whooping sound is made when the breath is drawn in. The coughing attacks may become so severe as to cause vomiting.

  - (2) Transmission -- transmitted by direct contact with an infected person, by droplet spread, or indirect contact with articles freshly soiled with discharges from the nose or throat of a patient.
  - (3) Control and prevention -- isolation of the patient for about three weeks. Direct contacts who have not been immunized should be quarantined for 14 days and excluded from school. The immunization of all children during infancy coupled with periodic boosters, is the best preventive measure.

(k) Tuberculosis
  - (1) Signs and symptoms -- vague chest pains, often with coughing, afternoon fever, fatigue, and loss of weight.
  - (2) Transmission -- transmitted by direct contact with an infected person, through droplet infection or indirectly through articles freshly soiled with saliva or sputum of tubercular patient.
  - (3) Control and prevention -- adequate sleep and rest, clean and pleasant surroundings, adequate and nourishing diet. Attempts to immunize man against this disease have been made through the use of BCG (Bacillus Calmette Guerin) vaccine.

(l) Dysentery
  - (1) Signs and symptoms -- intestinal inflammation, diarrhea, and watery stools containing blood, mucus, and pus.
  - (2) Transmission -- direct or indirect contact with sick patients or well carriers. The principal vehicles of spread are contaminated water and food -- milk and milk products, raw fruits and vegetables, and shellfish. Contamination from the unclean hands of carriers is a common method of spread. Flies may also be important vectors.
  - (3) Control and prevention -- dysentery cases should be isolated and family and immediate contacts should be examined and restricted from food handling. Adequate control depends upon a protected and treated water supply and the sanitary disposal of human excreta. Good personal hygiene by everyone is particularly necessary. Immunization for establishing artificial immunity with periodic boosters is a preventive measure.

(m) Cholera
  - (1) Signs and symptoms -- vomiting and profuse diarrhea -- "rice water" -- stools that result in a severe dehydration, loss of minerals, and increased blood acidity of the body tissues that leads to death.

(2) Transmission -- transmitted by contact and in water and food contaminated with excreta from patients and convalescent carriers. Flies may carry the organisms from infected wastes to food consumed by susceptibles.

(3) Control and prevention -- an active immunity of short duration can be produced by a vaccine made of killed vibrio comma. Control by improved sanitation is preferable to immunization.

(n) Scabies

(1) Signs and symptoms -- an itching disease of the skin characterized by a "breaking out" produced from the burrowing of the mite into the skin.

(2) Transmission -- by direct contact and to a limited extent from undergarments or soiled sheets freshly contaminated by infected persons.

(3) Control and prevention -- school children should not be allowed to return to their classrooms until they have been properly treated by a physician. Personal cleanliness, cleanliness of garments and bedclothes should be maintained.

(o) Ringworm

(1) Signs and symptoms -- formation of ring-shaped pigmented patches covered with blisters or scales on the skin. Infected hairs become brittle and break easily.

(2) Transmission -- by direct contact with cases, either man or animal, especially dogs, cats, and cattle. Sources of infection include backs of theater seats, barber clippers, toilet articles, or clothing contaminated with hair from infected animals or man.

(3) Control and prevention -- no child with ringworm should be readmitted to the classroom unless he has a note from a physician stating he is under care and treatment is started. Washable stocking caps should be worn at all times by the patient until he is cured.

(p) Rabies

(1) Signs and symptoms -- the disease is caused by the virus of rabies and starts with headaches, fever, a sense of apprehension, and muscle dysfunction.

(2) Transmission -- usually from the saliva of rabid animals -- the result of the bites of dogs, wild animals, and other domestic animals.

(3) Control and prevention -- most important preventive measure is the control of dogs and other animals. All domestic animals should receive active immunization for rabies. An important part of the control is to keep track of, or find

the animal that caused the bite. Observe the animal for evidence of rabies. If animal is alive and well after 14 days, it probably did not have rabies. Never kill the animal that has just bitten a person because the evidence of the disease will not be present at the early stage of the disease. The best prevention is to avoid animal bites.

(q) Malaria

(1) Signs and symptoms -- characterized by fever, enlargement of the spleen and anemia. The fever is accompanied first by chills then by sweating.

(2) Transmission -- transmitted to man by the bite of an anopheles mosquito.

(3) Control and prevention -- control depends chiefly upon the eradication of the anopheles mosquito. The use of insecticides and the elimination of stagnant water and other breeding places of mosquitoes must be stressed. Screening houses and the use of mosquito nets when sleeping will be of great help.

(r) Yellow and dengue fever

(1) Signs and symptoms -- yellow fever is characterized in severe cases by jaundice, albuminuria, and hemorrhage, dengue fever by rash and prostration accompanying the fever.

(2) Transmission -- enters the body through the bite of the aedes aegypti mosquito.

(3) Control and prevention -- like malaria, yellow and dengue fever can be controlled by vigorous campaigns against the aedes aegypti mosquito.

B. To know other illnesses that affect the different organs of the body.

1. Intestinal parasites

(a) Hookworms

(1) Signs and symptoms -- caused by a small parasitic worm. The bloodsucking activity of the worms, along with malnutrition often leads to anemia and may retard physical development and impair mental alertness.

(2) Transmission -- by eggs of the worm in feces deposited on the ground. The eggs hatch and develop into larvae which penetrate the skin (usually foot) of the person.

(3) Control and prevention -- the public should be educated as to the dangers of soil pollution (depositing of feces on the ground; and methods of prevention. Soil pollution is prevented through the use of sanitary toilets. Personal

care by cleanliness and the wearing of shoes should be stressed.

- (b) Tapeworm, trichina, ascaris
  - (1) Signs and symptoms
    - (a) Tapeworm -- loss of weight, pernicious anemia, and nervous disorders may arise. Emotional distress is the most common complaint. Serious damage to nervous system may sometimes result in insanity.
    - (b) Trichina -- similar to that of acute food poisoning or typhoid fever -- remittent fever, skin eruptions and diarrhea, respiratory involvement, inflamed muscles, swelling or edema may also occur.
    - (c) Ascaris -- loss of weight, intestinal obstruction may be a complication, anemia, droopiness, and diarrhea.
  - (2) Transmission
    - (a) Tapeworm -- eating raw or partially cooked beef, pork, or fish.
    - (b) Trichina -- eating raw or partially cooked pork, smoked but not cooked sausages and other pork products.
    - (c) Ascaris -- Insanitary practices like eating without washing the hands, eating raw vegetables that have not been thoroughly washed, improper disposal of waste, etc.
  - (3) Control and prevention
    - (a) Tapeworm -- eating thoroughly cooked beef, pork, and fish.
    - (b) Trichina -- eating thoroughly cooked pork and pork products. Restricting domestic pigs from preying on rats or feeding on raw scraps.
    - (c) Ascaris -- improving sanitary practices such as sanitary disposal of wastes, washing the hands thoroughly before eating, washing vegetables very well before eating them.

2. Deficiency diseases
   - (a) Scurvy
     - (1) Signs and symptoms -- bleeding gums and hemorrhaging.
     - (2) Cause - lack of Vitamin C or ascorbic acid.
     - (3) Prevention -- inclusion of fresh fruits and vegetables in the diet particularly citrus fruits.
   - (b) Rickets
     - (1) Signs and symptoms -- softening of the bones which then bend under the body's weight causing bowlegs and knock-knees.

(2) Cause -- lack of Vitamin D.
(3) Prevention -- inclusion of foods rich in Vitamin D such as codliver oil, eggs, butter, and milk. Vitamin D is also produced by the body when sunlight strikes the skin.

(c) (c) Beriberi
(1) Signs and symptoms -- painful degeneration of the nerves and in extreme cases can lead to paralysis or congestive heart failure.
(2) Cause -- lack of Vitamin B or thiamine.
(3) Prevention -- eating unpolished rice, whole cereals, nuts, and yeast.

(d) Night blindness
(1) Signs and symptoms -- loss of sight.
(2) Cause -- lack of Vitamin A.
(3) Prevention -- eating well balanced diets particularly eggs, liver, yellow vegetables, milk, and yellow fruits.

(e) Goiter
(1) Signs and symptoms -- an enlargement of all or part of the thyroid gland.
(2) Cause -- it results from a relative or absolute lack of iodine in the food or drinking water, also in certain areas where the soil is deficient in iodine.
(3) Control and prevention -- inclusion in the diet of foods rich in iodine such as sea foods and the use of iodized salt and water treated with iodine. Improved transportation of foods will greatly reduce the incidence of this disease.

(f) Anemia
(1) Signs and symptoms -- weakening of the body, malaise, pallor, and fatigability.
(2) Cause -- lack of iron in the diet or in some cases even though the diet is adequate, the iron cannot be absorbed through the digestive tract due to some factors like hypoacidity or prolonged vomiting.
(3) Control and prevention -- inclusion in the diet of foods rich in iron like liver, fresh fruits and vegetables, milk, and eggs.

3. Food poisoning
(a) Signs and symptoms -- abrupt and sometimes violent onset of nausea, vomiting, exhaustion, and often severe diarrhea. Botulism is a highly fatal poisoning characterized by headache, weakness, constipation, and paralysis of the eye muscles or other muscles.
(b) Transmission -- improper refrigeration of foods and careless handling of processed meat, ham, potato

salad, chicken salad, and other perishable foods. Dried milk powder and custard-filled pastry have also been involved.

Botulism is contracted through the consumption of undercooked canned meats and vegetables (often processed at home) or poorly packaged fish products.

- (c) Control and prevention -- prompt refrigeration of sliced or chopped meats, creamed or custard-filled desserts until served, immediate disposal or refrigeration of leftover foods, education of food handlers on how to maintain sanitation and cleanliness of kitchen, equipment, and good personal hygiene.

  Botulism may be prevented by adequate cooking or heating of prepared foods to inactivate the bacteria. There is no preventive immunization.

4. Tetanus
   - (a) Signs and symptoms -- characterized by painful muscular contractions, primarily of the lower jaw and neck muscles, secondarily of the trunk.
   - (b) Cause -- germs enter the body through an injury, often a puncture wound, but even insignificant and unnoticed wounds, contaminated with soil.
   - (c) Control and prevention -- educating the public about the danger of injuries and burns and the need after injury for either a booster (reinforcing) injection if previously actively immunized, or passive protection by tetanus antitoxin if not previously immunized. Active immunization with tetanus toxoid gives protection against tetanus.
5. Pediculosis (head lice)
   - (a) Signs and symptoms -- itching of the scalp or hairy parts of the body. Close examination of the involved areas will usually reveal the cause (the louse) Sometimes examination of the seams of clothing is indicated.
   - (b) Transmission -- by direct contact with an infected person or indirectly by contact with bedding or clothing and headgear of such persons.
   - (c) Control and prevention -- avoid physical contact with persons suffering with the condition and avoid direct contact with the contaminated articles of clothing. Education should be given in the value of using hot water and soap to maintain cleanliness, and laundering of clothing to destroy lice.
6. Asthma
   - (a) Signs and symptoms -- marked by attacks of wheezing, coughing, and a feeling of suffocation or inability to obtain adequate amounts of air.

  - (b) Cause -- precipitated by some incident as emotional stress, exertion, or irritation or by exposure to an exciting allergenic substance such as pollens, dust, foods, and drugs.
  - (c) Control and prevention -- no specific cures are available through therapy, but desensitization, symptomatic relief, and treatment of underlying infections usually are effective.
7. Kidney trouble
   - (a) Signs and symptoms -- stones in the kidney occur frequently and cause obstruction to urine flow. When a stone passes into the ureter the spasm of the ureteral muscle causes a violent pain. This is often accompanied by bloody urine as the stone tears small blood vessels.
   - (b) Cause -- the deposition of chemicals present in the urine due to overactivity of certain glands or when calcium salts are not dissolved or when too much milk is ingested.
   - (c) Control and prevention -- adequate intake of fluids and regular elimination of body wastes.
8. Heart attack
   - (a) Signs and symptoms -- shortness of breath, chest pain, bluish color of the lips and about the finger nails, a chronic cough, and swelling of the ankles. Pain in the left arm, in the head or neck, or indigestion manifested by nausea or vomiting is often associated with heart attacks.
   - (b) Cause -- overweight, emotional tension, and strenuous exertion contribute directly or indirectly to heart trouble.
   - (c) Control and prevention -- control of weight is important. Avoid emotional tension and strenuous exercise especially if you are not accustomed to it. A midday siesta of 20 minutes or more, bringing relaxation from the responsibilities of the day, is worthwhile.
9. Rheumatism
   - (a) Signs and symptoms -- muscle or joint pain, stiffness, or discomfort arising from non-specific disorders. Condition is precipitated by cold, dampness, or strain.
   - (b) Cause -- rheumatism arises from non-specific disorders.
   - (c) Prevention -- proper diet, sufficient rest and avoiding exposure of body parts to cold, dampness, or strain.

C. To know that:

1. bodily illnesses are not caused by celestial influence or wrath, malignant spirits, witches, sorcerers, or the evil eye, but by several factors such as disease germs and malnutrition.

   2. that disease does not simply arise out of the air but is spread by food, water, animals, and even people's hands.
   3. diseases caused by germs can be prevented.
   4. most of the old ways of curing and preventing illnesses are unsound but a few of them also help.

D. To know that some local plants such as the guava, the cinchona, the duhat tree, the tamarind, the eucalyptus, the papaya, the ebony tree, and several others have medicinal values.

E. To know that.

   1. penicillin, aureomycin, viocin, streptomycin, bacitracin, polymyxin, terramycin, and matromycin are some examples of antibiotics or modern "wonder" drugs.
   2. antibiotics are substances produced by microorganisms which inhibits the growth of, or destroys other microorganisms.
   3. the use of antibiotics:
      (a) has reduced significantly the death rates from infectious diseases.
      (b) has diminished the severity of certain infectious diseases.
      (c) has decreased markedly the average duration of many of the infectious diseases.
      (d) is not safe without the advice of a physician.

Evaluative Techniques and Procedures

The following are suggested techniques and procedures for evaluating each of the specific objectives of this unit. The test items -- objective and essay -- and non-testing procedures indicated under each objective are found in the Appendix under the experience area -- The Human Body and Its Care.

1. Objective 1
   (a) Objective tests -- See items I-1 through 5, 7, II-B-1-e, 9, 10, 11; II-C-2-a through h, II-E-2-b, c, d; III-B-1; III-C-2-a through e; III-D, III-E; III-F-2-f, i, j, l.
   (b) Essay tests -- See items I-a; 8-a, b.
   (c) Non-testing procedures -- See items II-1, 3, 4, 5, 6, 7, 9; VI-A-3-b, d, e, f, g, h, i, j, l, m, n.

2. Objective 2
   (a) Objective tests -- See items II-A-3, 10, 23, 26, 27, 28; II-C-3-a, b, d, e, g; II-C-4-a through g, II-E-2-a, e, f, g, II-E-3-a through m, III-E-3; III-F-1-a, b, g, h, i.

- (b) Essay tests -- See item 8-c.
- (c) Non-testing procedures -- See items II-5, 9; VI-A-3-b, d, i, k, l, m, n.

3. Objective 3
   - (a) Objective tests -- See items III-C-2-b, f; III-F-2-a through p.
   - (b) Essay tests -- See items 2-a; 3-c.

4. Objective 4
   - (a) Objective tests — See items II-C-5-a through f.
   - (b) Essay tests -- See item 4-b.

5. Objective 5
   - (a) Objective tests — See items III-C-2-f; III-F-2-g, h, III-G-1.
   - (b) Essay tests -- See items 5-a.

CHAPTER V

BEHAVIORAL GOALS THAT PERMEATE THE FIVE MAJOR EXPERIENCE AREAS SUGGESTED IN THE PHILIPPINE COURSE OF STUDY

The first major goal for science teaching in the elementary school stated in Chapter II -- to learn basic science facts, concepts, generalizations or principles -- was translated in terms of more specific content objectives in Chapter IV. To help teachers achieve these objectives, evaluative devices and techniques for obtaining and recording information about growth of children toward these objectives were constructed. However, the science information which we have specified and expect children to acquire cannot be assumed to be ends in themselves. As expressed in the rest of the major goals stated in Chapter II, our children, through the study of science, must be helped to develop certain skills, abilities, habits, attitudes, interests, and appreciations. The knowledge of science is of little value if there is no disposition to use it appropriately. Science teaching must aim to effect desirable changes in the way children think, feel and act, and the specific objectives of the science program must represent the changes which we hope to bring about. Skill in critical thinking, open-mindedness, a desire for accurate knowledge, interest in looking for explanation of natural phenomena, appreciation for the world in which we live -- these are illustrations of the specific behavioral objectives which the major science goals aim to develop. Many of these objectives that need to be evaluated are likely to slip away unnoticed unless the teacher has the objectives in mind and teaches so that the children can achieve them. For the improvement of classroom instruction, the teacher must know the nature of the pupil behavior that will be acquired when the major science goals have been achieved. He needs clear and immediate feedback evidence of the pupils' learning. Since it is impossible for a teacher to see what is taking place inside the children, the learnings will be inferred from the changes in the pupils' reactions. He must have specific expectations of how his particular children will react to a particular situation. Those constructing courses of study must therefore assume the responsibility for making clear to teachers the behaviors children are expected to develop. The present Philippine Course of Study will be of greater help to teachers if it includes, in addition to the specific content objectives suggested in Chapter IV, the behavioral characteristics indicative of the desirable skills and abilities, attitudes, habits, interests and appreciations we want children to develop.

As a next step to this study, the other major goals defined in Chapter II were translated in terms of specific behavioral objectives which can be developed in the process of teaching the experience areas suggested in the Philippine Course of Study. Specific pupil reactions indicative of the behavior goals are listed under each objective. It may not be possible to teach for and evaluate all of these behaviors in each unit. Not all the behaviors desired can be achieved by every child or in the class during the teaching of a particular unit. Certain units or experiences will lend themselves naturally to the development of certain behavioral objectives. If the teacher knows what to work for, she will be able to evaluate the degree to which behavioral objectives have been achieved. Determining the degree to which objectives have been met is nothing more than determining how the pupils behavior are observably different after a science experience from what it was before the experience. The question of how and how much children have changed as a result of their science experiences requires an extensive program of evaluation over a period of time. A single evidence of the presence or absence of these behaviors has little merit. A number of instances are needed to indicate a trend. Evaluation needs to be continuous and be based upon consistent pupil reactions that give evidence of a given behavior. It must employ appropriate and varied devices and techniques for obtaining and recording information about growth of children toward the desirable objectives.

To help teachers carry out an effective program of evaluation, the following steps have been undertaken. (1) stating the broad goals of science teaching defined in Chapter II in terms of 14 specific behavior objectives (these are indicated by Roman numerals in the following list), (2) listing under each behavior objective the specific pupil reactions that are indicative of the objective (see alphabetical listings under each of the 14 behavior goals), and (3) suggesting evaluative techniques and devices that may be used for determining growth towards each objective. The informal procedures and the sample forms of anecdotal records, checklists, questionnaires, inventories, rating scales, and logs which may be used are in the appendix.

Behavior Goals that Permeate Each of the Major Experience Areas Suggested in the Philippine Course of Study

- I. Do critical thinking
  - A. Can identify abstract definitions involved in a concrete example.
  - B. Can interpret written materials, pictures, charts and graphs accurately.
  - C. Can apply known principles and generalizations.
  - D. Can formulate valid conclusions and give reasons for such conclusions.
  - E. Can correctly analyze given data, illustrations or experimental procedures.
  - F. Can perceive the limitations or the relationships of given data.
  - G. Can evaluate suggestions given and make decisions wisely.
  - H. Can appraise situations.
  - I. Can tell whether or not a statement can be tested scientifically.
  - J. Can understand cause and effect relationships.
- II. Solve problems using the scientific methods
  - A. Recognizes and states the problem clearly.
  - B. Suggests or makes careful and intelligent plans for solving the problem.
  - C. Forms conclusions only after sufficient data or evidences have been collected.
  - D. Voluntarily uses resources, such as books, authorities, and audio-visual aids to gather data that are helpful to the solution of the problem.
  - E. Shows resourcefulness in suggesting substitute materials when those needed in the experiments are not available.
  - F. Sees the need for performing experiments.
  - G. Shows interest in and reasonable skill in performing experiments.
    - 1. Manipulates science equipment satisfactorily.
    - 2. Is accurate in one's measurements.
    - 3. Can predict the outcome of an experiment and could justify his predictions.
    - 4. Makes accurate records of the experiment.
  - H. Draws justifiable conclusions.
  - I. Questions validity of conclusions formed.
  - J. Suggests repeating the experiment to check whether or not the same results will be obtained.
  - K. Looks for sources of authoritative evidence to corroborate the results of the experiment.
  - L. Applies what he has learned to interpret a new situation.

- III. Observe and record observations accurately
  - A. Can make quantitative as well as qualitative observations.
  - B. Can make valid and reliable comparisons.
  - C. Can observe and note subtle differences or changes in objects, phenomena or experimental behavior.
  - D. Can organize and classify one's observations.
  - E. Can report accurate descriptions of what has been observed.
- IV. Read science content with understanding
  - A. Have acquired a basic working vocabulary of science terms.
  - B. Can interpret and analyze science facts, symbols, concepts, principles, or generalizations.
  - C. Can synthesize ideas into meaningful wholes.
  - D. Can evaluate what they read.
- V. Use more than one source of information
  - A. Consults more than one reference material in his preparation for the discussion of a topic.
  - B. Interviews and or listens attentively to resource persons invited.
  - C. Views films and slides, looks for pictures; joins and is observant during field trips.
- VI. Consult reliable sources and authorities for information
  - A. Inquires for the source or sources of the information before accepting it.
  - B. Consults up-to-date reading materials.
    - 1. Checks the date of the publication of source materials before using them.
  - C. Consults reading materials of reliable authorship.
    - 1. Inquires about the qualifications of the authors.
  - D. Distinguishes between science books that are read for fun and those that are read for reliable information.
  - E. Distinguishes between opinions and facts.
  - F. Shows awareness that printed matter is not always accurate.
  - G. Detects propaganda.
  - H. Interviews persons who are qualified in the field in which information is sought.
- VII. Label the source of information they contribute in discussions and in written work
- VIII. Challenge questionable information given by others and accept challenges of their own explanation good naturedly
- IX. Develop open-mindedness
  - A. Listens to and considers the ideas and suggestions of others.
  - B. Is willing to check one's ideas anytime.
  - C. Changes his ideas when new and valid evidences were presented.

D. Does not jump to conclusions or make decisions on the basis of one observation.
E. Shows awareness that not all printed matters are accurate.
F. Refuses gossip, hearsay or rumor as a source of information.
G. Does not allow his decisions to be affected by personal likes or dislikes, anger, fear and ignorance.
H. Recognizes that there are specialists in the area under consideration.

X. Develop a feeling of responsibility to oneself, to others, and to one's environment
A. Shows awareness of keeping one's self healthy and of protecting the health of others.
B. Shows awareness of the needs of living things.
C. Protects and keeps clean public properties and places of natural beauty.
D. Shows awareness of the value of materials.
E. Thinks through the possible consequences of one's behavior.
1. Plans experiments, excursions, and other activities in such a way as to avoid accidents.
2 Is discreet in destroying things, living or non-living, unless there is good reason for doing so.
F. Avoids removing anything from property that does not belong to him unless permission has been secured.
G Shows awareness of the need for conserving and making wise use of natural resources.

XI. Is curious and interested in one's environment
A. Asks questions about objects and happenings in the environment.
B. Observes natural phenomena and objects as a result of one's own curiosity.

XII. Is interested in looking for explanations of natural phenomena
A. Recognizes causes and effect relationship.
B. Rejects superstitions, myths, magic, astrology, teleology as explanations of the things that happened around him.
C. Uses his previous learnings as a basis for interpreting observations.

XIII. Develop science interests for leisure time
A. Reads science books, magazines, news articles, and fiction.
B. Reads about scientists and inventions.
C. Makes collections, plays science games, owns science toys, and equipment.
D. Watches science TV programs, goes to science fairs, museums, and planetariums, and goes on science field trips.
E. Pursues science hobbies.

F. Participates actively in science fairs and class exhibits.
G. Makes drawings, composes songs, writes poems with nature or science themes.

XIV. Develop appreciation for the world in which they live
  A. Recognizes and appreciates the beauty and harmony in nature.
  B. Appreciates the contributions of scientists in their daily lives.
  C. Appreciates the value of natural resources.
  D. Appreciates the tools and techniques of science.

Evaluative Techniques and Procedures

The following are suggested techniques and procedures for evaluating each of the 14 behavior goals that permeate the five experience areas suggested in the Philippine Course of Study. Objective and essay tests were constructed for each experience area. Sample forms of anecdotal records, checklists, questionnaires, inventories, rating scales, and logs were devised. Suitable forms to use for evaluating each specific desired behavior are indicated. All these evaluative devices are found in the Appendix.

I. Do critical thinking

Objective tests: For evaluating specific pupil reaction
A -- see test items II-E, III-A, III-B of Experience Area 4.
B -- see test items IV-A of Experience Area 1, IV-B, IV-F of Experience Area 2; V-A, V-C of Experience Area 3, III-F of Experience Area 4, and III-B, III-D of Experience Area 5.
C -- see test items IV-G, IV-I of Experience Area 1, V-G, V-D, V-E of Experience Area 3; III-A, III-B, III-D, III-E of Experience Area 4; III-A, III-B, III-D, III-E, III-F-1 and 2, III-G of Experience Area 5.
D — see test items IV-C, IV-F of Experience Area 1, IV-E of Experience Area 2; III-E of Experience Area 3, V-E of Experience Area 4; III-E, III-G of Experience Area 5.
E -- see test items IV-C of Experience Area 1, IV-F, IV-G-1 of Experience Area 2; III-B, III-F, III-G of Experience Area 4; IV-A, V-B, V-C of Experience Area 3; III-D of Experience Area 5.

F -- see test items IV-A, IV-C, IV-H, IV-I of Experience Area 1, IV-B, IV-F, IV-G of Experience Area 2, V-A, V-B, V-C, V-D, V-E of Experience Area 3; III-B, III-F, III-G of Experience Area 4, III-B, III-D, III-E, III-F, III-G of Experience Area 5.
G -- see test items IV-C of Experience Area 1, IV-C of Experience Area 2, V-E of Experience Area 3, III-H of Experience Area 4; III-F of Experience Area 5.
H -- see test item IV-D of Experience Area 1.
I -- see test items IV-B of Experience Area 1, III-C of Experience Area 4.
J -- see test items IV-I of Experience Area 1, IV-G of Experience Area 2, V-B of Experience Area 3; III-G of Experience Area 4.

Essay tests For evaluating specific pupil reaction
C -- see test items 1 through 8 of Experience Area 1, 4 of Experience Area 2, 1 through 3 of Experience Area 3, 1 through 3 of Experience Area 4, 3, 4, 6 through 9 of Experience Area 5.
E -- see test items 9 of Experience Area 1, 6 and 8 of Experience Area 5.
F -- see test items 7 of Experience Area 1, 1 of Experience Area 4; 1 and 2 of Experience Area 3; 3, 4, 6, 8 of Experience Area 5.
G -- see test item 5 of Experience Area 1.
J -- see test item 12 of Experience Area 1; 3 of Experience Area 5.

Anecdotal records See Form A. All the other forms may also be used utilizing specific reactions I-A through J instead of those given in the samples.

Checklists. Forms B through E may be revised such that specific reactions I-A through J are utilized instead of those given in the samples.

Questionnaire and inventories: Forms A and B may be used using reactions I-A through J instead of those in the sample.

Rating scale: Forms A and B may be used using reactions I-A through J instead of those in the samples.

Informal techniques. For evaluating specific pupil reactions
A -- see items 1 through 7, 13, 16, 39, 42, 46
B -- see items 1 through 7, 13, 15, 16, 22, 26, 33, 34, 39, 42, 46
C -- see items 1 through 7, 13, 15, 16, 31, 33, 34, 39, 42, 46
D -- see items 1 through 7, 16, 22, 27, 31, 33, 34, 39, 46, 48

E -- see items 1 through 7, 16, 27 31, 34, 39, 46
F -- see items 1 through 7, 13, 15, 16, 26, 27, 31, 33, 34, 39, 42, 46, 48
G -- see items 16, 22, 26, 27, 31, 33, 34, 39, 46, 48
H -- see items 16, 26, 31, 33, 34, 39, 46
I -- see items 16, 39
J -- see items 16, 33, 39

II. Solve problems using the scientific methods

Objective tests : For evaluating specific pupil reactions
A -- see test items IV-C, IV-E of Experience Area 1, III-E of Experience Area 4; III-G of Experience Area 5.
B -- see test items IV-C, IV-E of Experience Area 1, III-E of Experience Area 4; III-G of Experience Area 5.
C -- see test items IV-C, IV-E of Experience Area 1; III-E of Experience Area 4; III-G of Experience Area 5.
G-J -- see test items IV-C, IV-D of Experience Area 1, IV-F of Experience Area 2, III-C, V-C, V-D of Experience Area 3, III-B, III-H, III-I of Experience Area 4.
H and I -- see test items IV-C, IV-D, IV-E, IV-F of Experience Area 1, IV-C, IV-E, IV-F of Experience Area 2, V-C, V-D, V-E of Experience Area 3, III-B, III-E of Experience Area 4; III-B, III-C, III-D, III-E, III-F, III-G of Experience Area 5.
L -- see items IV-D, IV-E, IV-F, IV-G of Experience Area 1; IV-C, IV-D, IV-E, IV-F of Experience Area 2, V-A, V-C, V-D, V-E of Experience Area 3; II-G, III-D, III-E, III-F, III-H of Experience Area 4; III-A to F of Experience Area 5.

Essay tests: For evaluating specific pupil reaction
L - see items 1, 5, 6 of Experience Area 1, 2, 3, 4 of Experience Area 2, 1, 2, 3, 4, of Experience Area 3; 2, 3, 5 of Experience Area 4; 2, 3, 5, 6, 8, 9, 10 of Experience Area 5.

Anecdotal records: See Form B, or use specific pupil reactions II-A through L instead of the reactions given in the samples, Form A and D.

Checklists. See Form B and Form C. Form E may be used utilizing reactions II-A to L. Form A may be used to evaluate reactions D and K.

Questionnaire and inventories. See Forms A and B. These forms may be utilized if reactions II-A to L are used instead of those given in the samples.

Rating scale. See Forms B and D. Forms C and H may be revised such that reactions II-A to L are utilized instead of those given in the samples. For evaluating pupil reactions D and K, Form A may be used.

Informal techniques. For evaluating specific reactions
A -- see items 7, 31
B -- see items 7, 31
C -- see items 7, 31
D -- see items 7, 18, 19, 20, 27
E -- see items 7
F -- see items 7, 36
G -- see items 7, 36
H -- see items 2, 3, 4, 7, 36
I -- see items 7, 36
J -- see items 7, 36
K -- see items 7, 36
L -- see items 2, 3, 4, 7, 18, 19, 20, 27, 31, 33, 34, 36, 39

III. Observe and record observations accurately

Objective tests: For evaluating specific reactions
A -- see test items II-A, B, C, D, E, H, I, J, III-D, E, F of Experience Area 1; II-A, III-B, IV-A, IV-D, IV-G, V-A of Experience Area 2, III-B, C, V-C of Experience Area 3; III-B, III-G of Experience Area 4.
B -- see test items II-A, B, C, D, E, H, I, J, III-D, E of Experience Area 1, II-A, III-B, V-A of Experience Area 2; III-B, C, V-C of Experience Area 3; III-B of Experience Area 4.
C -- see test items II-A, B, C, E, H, I, J, III-D, E, F of Experience Area 1, II-A, III-B, IV-A, IV-D, IV-G, V-A of Experience Area 2, III-B, C, V-C of Experience Area 3, III-B, III-G of Experience Area 4.
D -- see test items II-A, D, E, H, I, J of Experience Area 1, II-G, III-G of Experience Area 4.
E -- see test items II-B of Experience Area 1; V-A of Experience Area 2.

Essay tests: For evaluating specific reactions
A -- see items 11 of Experience Area 1; 1 of Experience Area 4; 4, 7 of Experience Area 5.
B -- see items 11 of Experience Area 1; 1 of Experience Area 4; 4, 7 of Experience Area 5.
C -- see items 11 of Experience Area 1; 4, 7 of Experience Area 5.
D -- see items 11 of Experience Area 1; 4, 7 of Experience Area 5.
E -- see items 11 of Experience Area 1

Anecdotal records For evaluating specific reactions
A, B, C, D, and E see Form C. Forms A, B, C, and E can also be used if reactions III-A to III-E are used instead of those

given in the samples.

Checklists: Forms A to E can be revised such that reactions III-A to III-E are used instead of those given in the samples.

Questionnaires and inventories: Forms A, B, E may be used if reactions III-A to III-E are used instead of those given in the samples.

Rating scales: Forms B and C may be revised such that reactions III-A to III-E are used instead of those given in the samples.

Informal techniques: For evaluating specific reactions
A -- see items 8, 9, 10, 11, 12, 13, 33, 36, 38, 44, 45, 47
B -- see items 10, 11, 12, 13, 33, 36, 38
C -- see items 8, 9, 10, 11, 12, 13, 33, 36, 38, 45, 47
D -- see items 10, 11, 12, 13, 33, 36, 38, 44, 45
E -- see items 6, 8, 9, 10 11, 12, 13, 33, 36, 38, 44, 45

IV. Read science content with understanding

Objective tests A high score obtained in the objective tests by a child show evidence of the acquisition of this skill.

Essay tests: A high rating in the essay tests is also one evidence of the acquisition of this ability.

Anecdotal records Any of the forms suggested in the Appendix under Anecdotal records may be revised to suit the purpose.

Checklist. Forms B, C, D, E may be revised such that reactions IV-A to D are used instead of the reactions given in the samples.

Questionnaires and inventories: Forms A and B may be used by utilizying reactions IV-A to D instead of those used in the samples.

Rating scales: Forms A, B, C may be revised by using reactions IV-A to D instead of those used in the samples.

Informal techniques. For evaluating specific reactions IV-A to D see items 4, 16, 17.

V. Use more than one source of information

Objective tests and essay tests. If the items given in the tests have been taken from varied sources then a high score in these tests will give an evidence of the pupils' use of multiple resources.

Anecdotal records: Forms A, B, D, and E are suitable for use in evaluating growth toward this behavior goal if reactions V-A, B, C are used instead of those in the samples.

Checklists: For evaluating specific reactions V-A, B and C see Form A. The other forms are also suitable for evaluating growth toward this behavior goal.

Questionnaires and inventories. Forms A and B may be revised by utilizing reactions V-A, B, and C instead of the reactions used in the samples.

Rating scales. For evaluating specific reactions V-A, B, and C see Form A. Form B may also be revised to suit the purpose.

Informal techniques: To evaluate growth toward specific reaction
A — see items 17, 18, 19, 20, 23, 24, 27
B — see items 18, 19, 20, 24, 27
C — see items 18, 19, 20, 24, 27

VI. Consult reliable sources and authorities for information

Objective tests and essay tests. If the items in these tests have been selected from the information given by the sources and authorities the teacher wants the children to consult, then a high score in these tests give evidence of this behavior objective.

Anecdotal records. Any of the forms given in the Appendix may be used provided reactions VI-A through H are substituted for those given in the samples.

Checklists: See Form A. Forms B, C, D and E are also suitable if reactions VI-A through H are used instead of those given in the samples.

Questionnaires and inventories: Forms A and B may be revised by using reactions VI-A through H in place of those used in the samples.

Rating scales. See Form A. Forms B, C, and H are also suitable if reactions VI-A through H are used instead of those given in the samples.

Informal techniques. For evaluating specific reactions
A through H — see items 21, 24, 25
G — see item 22-a
B, C, D, F — see item 22-b
A, B, C, D, F — see item 23

VII. Label the source of information they contribute in discussions and in written work

Anecdotal records: Any of the forms suggested in the Appendix may be used for recording evidences of growth toward this behavior objective A tape recorder may be used during class discussions.

Checklists. A checklist of children's names may be prepared and a check mark may be placed opposite the name of any pupil who exhibits evidence of this behavior.

Questionnaires and inventories: See Forms A and B

Rating scales: See Form A. Form B may also be used for this purpose.

Informal techniques: See items 19 and 20

VIII. Challenge questionable information given by others and accept challenges of their own explanation good naturedly

Anecdotal records. Any of the forms suggested in the Appendix may be used for recording evidences of growth toward this behavior objective. A tape recorder may be used during discussions.

Checklists: A checklist of the children's names may be prepared and a checkmark may be placed opposite the name of any pupil who exhibits evidence of this behavior trait.

Questionnaires and inventories: See Forms A and B

Rating scales: Form B may be used using this behavior trait instead of those given in the samples.

Informal techniques: See item 19

IX. Develop open-mindedness

Anecdotal records See Form D-2. Forms A, B, and E may also be used for this purpose.

Checklists: See Form E. Forms B, C, and D are also suitable if instead of the reactions used in the samples, reactions IX-A through H will be used.

Questionnaires and inventories See Form B. Form A may also be used if reactions IX-A through H will be used instead of those given in the sample.

Rating scales: See Form E. Forms A, B, and C may be revised such that reactions IX-A through H will be used instead of those in the sample.

Informal techniques: For evaluating specific reaction
A, C, and H -- see item 26
B and H -- see item 27
D -- see item 12
E -- see item 25

X. Develop a feeling of responsibility to one's self, to others, and to one's environment.

Objective tests. For evaluating growth toward specific reaction
A -- see items II-F of Experience Area 1; I, II, III of Experience Area 5
B -- see items II-A, II-F, II-G, III-A, III-B, IV-B, IV-C, D, E, G of Experience Area 1
G -- see items II-G, III-A, C of Experience Area 1

Essay tests: For evaluating specific reaction
A -- see items 4 of Experience Area 4; 1 through 6, 8 through 11 of Experience Area 5
B -- see items 6, 10, 12 of Experience Area 1
C -- see items 6, 10, 12 of Experience Area 1
E -- see items 1 of Experience Area 1
G -- see items 1, 6, 10, 12 of Experience Area 1

Anecdotal records: See Form D-3, and Form E. The other forms are also suitable if reactions X-A through G are used instead of those in the samples.

Checklists: See Form B. Forms B and C may be used if reactions X-A through G are utilized instead of those given in the samples.

Questionnaires and inventories: See Forms A, B, C, and D. These forms may be used for evaluating growth toward specific objectives X-A through G.

Rating scales: See Forms C and G. Forms A and B are also suitable if reactions X-A through G are utilized instead of those given in the samples.

Informal techniques: For evaluating specific reaction
A -- see items 31, 32 and Performance Tests 1 through 5 of Experience Area 5.
D -- see items 28, 33
B, C, F, G -- see items 29, 30, 31, 33, 34. Non-Testing Procedures, items A-1, 2, 4, 5; B, C of Experience Area 1; I through VI of Experience Area 5.

XI. Is curious and interested in one's environment

Anecdotal records: Any of the forms suggested in the Appendix may be used for evaluating growth toward this behavior goal.

Checklists See Form D, Forms B, C, and E may also be used if reactions XI-A and B are substituted for those given in the samples.

Questionnaires and inventories: Forms A and B may be revised such that reactions XI-A and B are used instead of those given in the samples.

Rating scales: Forms A, B, C, and F are suitable for evaluating growth toward this objective if reactions XI-A and B are used instead of those given in the samples.

Informal techniques. For evaluating specific reaction
A — see items 11, 30, 31, 35, 36, 37, 38
B — see items 35, 36, 38

XII. Is interested in looking for explanations of natural phenomena

Objective tests: For evaluating specific reaction
A — see items IV-I of Experience Area 1, IV-G of Experience Area 2, III-A, V-A, V-B, C, D of Experience Area 3; II-E, III-B, D, G, H of Experience Area 4; II-A, II-E-2, 3, III-C-1, 2, III-F-1, 2, 3 of Experience Area 5.
B — see items IV-I of Experience Area 1; IV-G of Experience Area 2; V-A, B of Experience Area 3; III-C-2, III-F-2 of Experience Area 5.
C — see items III-C, IV-E, G, I of Experience Area 1; II-A, III-A, IV-A, C, D, E, F, G of Experience Area 2, III-A, V-A, B, C, D of Experience Area 3; II-E, III-B, D, G, H of Experience Area 4; II-A, E-2, 3, III-C-1, 2, III-F-2 of Experience Area 5.

Essay tests: For evaluating specific reaction
A -- see items 12 of Experience Area 1; 4 of Experience Area 2; 1, 2, 3, 4 of Experience Area 3; 4 of Experience Area 4, 1, 2, 3, 5, 6, 8, 9 of Experience Area 5.
B — see items 3 of Experience Area 3; 2 of Experience Area 5.
C — see items 12 of Experience Area 1; 1, 3, 4 of Experience Area 3; 4 of Experience Area 4; 1, 2, 3, of Experience Area 5.

Anecdotal records. Forms A, B, D, and E are suitable to use if reactions XII-A, B, and C are used instead of those given in the samples.

Checklists: See Form D. Forms B, C, E may be revised such that reactions XII-A, B, C are used instead of those given in the samples.

Questionnaires and inventories Forms A and B may be used by substituting reactions XII-A, B, and C for those given in the samples.

Rating scales. Forms A, B, C, D, H may be used if reactions XII-A, B, C are substituted for the reactions given in the samples.

Informal techniques: For evaluating specific reactions XII-A, B, C see items 38 and 39.

XIII. Develop science interests for leisure time

Anecdotal records: See Form D. Forms A, B, and E may be used by substituting reactions XIII-A through G in place of those used in the samples.

Checklists: See Form D. Forms B, C, and E may be revised such that reactions XIII-A through G are used instead of those given in the samples.

Questionnaires and inventories: See Forms D and F. Forms A, B, and E may be used by substituting reactions XIII-A through G in place of the reactions given in the samples.

Rating scales: See Forms F and H. Forms A, B, and C may be used if reactions XIII-A through G are utilized instead of those given in the samples.

Informal techniques: For evaluating specific reactions
A -- see items 4, 18, 20, 23, 35, 37, 40, 43, 44
B -- see items 18, 20, 23, 35, 40, 43, 44, 46, 47, 48
C -- see items 35, 36, 40, 41, 43, 47
D -- see items 35, 41, 43, 44, 46
E -- see items 35, 40, 41, 43
F -- see items 13, 41, 43
G -- see items 15, 42

XIV. Develop appreciation for the world in which they live

Anecdotal records: See Form E. Forms A and B are also suitable if reactions XIV-A through D are used instead of those given in the sample.

Checklists: See Form E. Forms B, C, and D may be revised such that reactions XIV-A through D are used in place of the reactions given in the sample.

Questionnaires and inventories: See Form D, E, and G. Forms A and B may be used if reactions XIV-A through D are used in place of those given in the samples.

Rating scales: See Form G. Forms A, B, C, and H are also suitable if reactions XIV-A through D are used in place of those given in the samples.

Informal techniques. For evaluating specific reaction
A -- see items 42, 45, 46
B -- see items 44, 46, 47, 48, 49
C -- see items 29, 30, 31, 33, 34-2, 35, 42, 47, 48
D -- see items 7, 12, 18, 20, 25, 27

CHAPTER VI

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Summary

This study stemmed from the newer philosophy of science teaching which called for the development of more adequate techniques and procedures of assessing pupil growth and development. This philosophy has emphasized the responsibility of elementary schools not only for the teaching of science information but also for the stimulation of pupil growth towards development of desirable concepts, skills, abilities, habits, attitudes, interests, and appreciations It has stressed the importance of pupil behavior as a result of science learning over and above the child's ability to reproduce science facts. These changes in the nature and objectives of science education brought about a pressing need for the development of a more comprehensive and effective evaluation program in the elementary schools. In answer to this need, this study was undertaken to call the teachers' attention to meaningful outcomes which need to be measured more carefully and more extensively than is now the case. It was designed to suggest behavioral goals and to make available to science teachers techniques and procedures which have been developed and found in the literature which might help evaluate growth towards the objectives set up for the sixth grade science program in Manila.

The study involved three major steps: (1) statement of the major purposes for science teaching found in the Philippine Course of Study and comparison of those goals with those found in the literature of the United States, (2) formulation of a set of goals for the sixth grade science program in Manila and translation of these major goals into specific content and pupil behavior objectives, (3) selection and development of techniques and procedures that may be used in appraising the growth of pupils towards these content and behavior objectives.

The major purposes for teaching elementary science stated in the Philippine Course of Study were compared with those found in the literature in the United States in order to enrich and improve the sixth grade science program in Manila. From this comparison, a set of goals was formulated. The goals were of two types — helping children learn basic science information and developing desirable behaviors in the process. This set of goals was used as a guide or framework for determining more specific content and behavioral objectives for each of the 14 suggested teaching units in the Philippine Course of Study.

To determine the specific content objectives the units or content suggested in the Philippine Course of Study which have been selected to achieve the general goals were studied. Problems pertinent to the study of each unit and which children are likely to raise were anticipated. These were stated at the beginning of each unit. Then basic science information -- facts, concepts, generalizations or principles — which are important to teach to help children solve the problems were listed and stated as specific content objectives for each unit.

After the specific content objectives for each unit were determined, the general goals which aim to develop desirable behavior were stated in terms of more specific behavioral objectives. Specific pupil reactions indicative of each behavior were compiled and listed in order to make these objectives more meaningful and easier to evaluate.

To provide effective means for appraising the achievement of the specific content and behavioral objectives, a survey of evaluative techniques and procedures suggested in the literature was made. From the findings of the survey, devices, techniques, and procedures appropriate for evaluating pupil growth towards the specific content and behavioral objectives were selected, adapted, and developed. Sample evaluative instruments and procedures were devised. Suitable devices and procedures for evaluating each of the specific content and behavioral objectives were also indicated.

In selecting and developing the evaluative techniques and devices, certain principles were kept in mind. The test situations used in the tests were not simply selected from a few general types of tests now in use in the elementary schools in Manila, but were obtained directly from the analysis of the content and behavioral objectives. Varied types of tests were developed and selected tests from the literature were adapted so that evidences of growth not only with reference to children's mastery of subject matter but also to the degree to which they are attaining skills in critical thinking, in solving problems scientifically, in observing accurately, and other important goals which we are trying to reach in science education might be obtained.

A quality sought in the evaluative instruments and procedures selected and developed was its practicability from the standpoint of time, effort and facilities required. Evaluative instruments like the standardized tests now available in the United States and performance tests that require equipment were thought to be too expensive and beyond the reach of many of our public schools and teachers. They were therefore not selected. Likewise, methods which require a great deal of additional time and effort on the part of the classroom teacher, such as oral tests and individual pupil interviews, were utilized only to a limited degree. Because of the big enrollment in the intermediate classes of Manila and of the departmentalized program of instruction in the city schools, it is likely that methods such as this will not be used by the majority of classroom teachers.

Practicability and variety were also qualities considered in developing forms for recording behavior. Simple anecdotal records, observation checklists, rating scales, inventories and questionnaires were devised, not only because they require less time to handle and use but also because they provide accurate descriptions of significant in and out-of-school behavior of children that can be evaluated more objectively.

An examination of the devices and methods of appraisal selected and developed will show that special care was taken for the provision of a continuous, comprehensive and cooperative evaluation program. Techniques and procedures that can be used in different phases of the teaching process, in every unit, at the beginning, middle and close of the school year were devised for the science teacher. Provision was also made for the appraisal of written, oral, field trip, and laboratory experiences as well as in and out-of-school project activities. Opportunities for the participation in the evaluation program of all -- teacher, pupils, and parents -- have also been made.

It is hoped that this study will be of service in defining more clearly the objectives for science teaching in the sixth grade classes of Manila and will help teachers become aware of possible devices and techniques for appraising growth of children towards these objectives. The study aims to make its humble contribution to the improvement of evaluation and ultimately to the improvement of classroom instruction.

Conclusions

The major purpose of this study was to develop techniques and procedures for evaluating pupil growth towards the objectives set up for the sixth grade science programs in the elementary schools in Manila. To achieve this objective, the writer attempted to answer the questions stated in Chapter I. These questions are restated below with conclusions drawn from the results of the study.

1. How do the general objectives suggested in the Philippine sixth grade course of study compare with those found in the literature in the United States? What additional objectives found in the literature will improve and enrich the present sixth grade science program in Manila?

A comparison of the general objectives suggested in the Philippine Course of Study with those found in the literature of the United States show that (1) two of the five general objectives in the Philippine Course of Study -- "to understand and appreciate the contributions of science to modern life" and "to appreciate the value of the scientific methods and to learn to use them in dealing with the simple everyday problems of personal and social living" -- were among the widely accepted science objectives in the United States, (2) the rest of the general objectives -- "to understand cause and effect relationship"; "to appreciate the importance of protecting plant and animal life"; "to learn to utilize natural resources wisely" -- were found to be only a small part of the comprehensive listing of understandings, attitudes, interests, and appreciations that have been proposed in the literature in the United States for children to acquire.

Greater emphasis probably needs to be placed on the development of other behaviors such as open-mindedness, curiosity, critical-mindedness, resourcefulness, accuracy, and intellectual honesty. It seems that greater stress is also needed on the development of skills and abilities -- both intellectual and manipulative -- and on the development of science interests and appreciations. Science instruction has a great potential, not only in helping children develop the skills by which knowledge may be acquired and tested, but also in generating in them an awareness of the wonders of the world.

2. How can the general science objectives for the sixth grade science program of Manila be stated in terms of content and specific pupil behavior?

There seems to be a need for those constructing courses of study to assume the responsibility of including in these teaching guides not only the general objectives and the content for achieving these objectives but also the specific content and behavioral objectives. The teaching units suggested in the Philippine Course of Study will be more helpful to classroom teachers if each unit includes the problems pertinent to the study of the unit, the specific content and behavioral objectives, the experiences and materials that will help carry out the objectives and the evaluative devices and procedures that can be used in appraising the achievement of the specific objectives. Evaluation of science teaching would be improved if the content objectives specify clearly the basic concepts, generalizations, or principles that children are expected to learn, and if specific pupil reactions indicative of each behavior desired are spelled out.

3. What evaluation techniques and procedures are suggested in the literature and research?

Numerous techniques and procedures suggested in the literature and research were found useful to this study. These techniques and procedures can be classified into two groups -- testing and non-testing procedures. The testing procedures included the paper and pencil tests which were either teacher-made or commercial, the oral tests, and the performance tests. Non-testing procedures included informal techniques such as examining pupil work products, studying records of foods eaten, analyzing attendance records, interview with parents or taking note of a pupil's reaction towards immunization and the use of anecdotal records, checklists, questionnaires, inventories, and rating methods that summarize the results of observing samples of pupil behavior or products of that behavior. Varied types of tests for measuring children's acquisition of science facts, concepts, generalizations, and principles, ability to read and understand science materials, to think critically; to observe accurately; and to solve problems scientifically were found in the literature.

4. Which of these and what other techniques and procedures may be developed to help teachers appraise the growth of pupils toward the objectives of the science experiences?

The various types of objective tests found in the literature, particularly the tests designed by Bloom (47) to measure achievement of objectives in the cognitive domain -- knowledge, comprehension, application, analysis, synthesis, and evaluation, -- the tests devised by Packer (48) and Nelson (1) to determine the level of children's understanding of concepts and principles; the instruments developed by Dunning (43), Dressel (53), Tylor (56), Bradfield and Moredock (55) to evaluate aspects of critical thinking and ability to solve problems scientifically, the devices reported by Reiner (61,64), Bradfield and Moredock (55) that test children's understanding of causes and effect relationships, the picture tests reported by Boener (51) for measuring children's comprehension of science concepts and the tests developed by Colhurst (60) and Munch (58) to determine pupils' ability to observe accurately were found very helpful in developing evaluative devices and procedures used in this study. These tests were used as models in constructing evaluative instruments for appraising evidence of growth, not only in the acquisition of basic science knowledge, but also towards the thought processes.

Aside from these objective tests, several types of essay tests seem suitable for measuring children's ability to analyze problems, think critically, recall and interpret previous knowledge, organize and present ideas, and arrive at conclusions. These tests were aimed also to help teachers gain insight into the children's interests, attitudes and appreciations. Several types of essay questions were prepared for each of the teaching units suggested in the Philippine Course of Study.

While written tests made their unique contributions in this study, other techniques such as observation of significant behavior inside and outside the classroom, interviews, questionnaires, inventories, study of pupils' records of activities, examination of pupils' work products were also employed in reasonable proportion in this study. No one type of procedure was found to have a monopoly of advantages for the purpose of securing evidence of a particular behavior. Each device or procedure has its own peculiar merit.

Provision for adequate and systematic records of behavior was also made. Since a particular behavior can be evaluated more objectively and with greater validity as the number of records increases, different sample forms of anecdotal records, checklists, inventories, questionnaires, and rating scales were devised.

Although a great variety of evaluation techniques and procedures for appraising behavioral outcomes are now available, it is recognized that for measuring certain desired outcomes present devices for evaluating pupil behavior are still inadequate. It is probably important that each teacher recognize what he is trying to measure and to what extent his measuring device is effective.

5. What paper and pencil instruments can be developed which will measure children's acquisition of science knowledge, ability to think critically, solve problems scientifically, and determine evidences of growth towards the development of desirable attitudes, habits, interests, and appreciations?

An important part of this study was the development of paper and pencil instruments which were designed to evaluate growth towards the specific science content and behavioral objectives. Utilizing the content of the sixth grade Course of Study, tests were designed to measure children's knowledge of science terminology; basic science facts, concepts, generalizations, or principles; knowledge of conventions, sequences, classifications, categories, criteria, theories and structures; ability to think critically, read and understand science materials, solve problems scientifically and observe accurately.

Different sample forms of anecdotal records, checklists, inventories, questionnaires, and rating scales were also devised to make provision for an adequate and systematic recording of significant pupil reactions indicative of each specific behavior objective.

The development of paper and pencil instruments is important for effective evaluation of science teaching. This appears to be a big job and can probably be accomplished by committees pooling and sharing resources of information, talent and secretarial help. It is hoped that more of this will be encouraged, for evaluation is indispensable to and inseparable from the teaching process.

Recommendations

1. In the light of the review of the science goals proposed in the literature in the United States and the comparison made between these and those stated in the Philippine Course of Study, there seems to be a need for setting up broader objectives for the science program in Manila. Greater emphasis should probably be placed on the development of behavioral goals. It cannot be assumed that behavioral implications will be self-evident and that children will act in a manner consistent with the knowledge they have learned. Only those things toward which teaching is specifically directed are likely to be accomplished.

2. Since the Philippine Course of Study in Elementary Science is a guide for possible teaching, its effectiveness will depend on what it communicates to teachers. The course outline would probably be of greater help to teachers if:

(a) the goals stated for science teaching are translated in terms of specific content and pupil behavior objectives

(b) the scope is enriched to include new science knowledge and developments

(c) adequate and suitable activities that will carry out not only the content but also the behavioral objectives are provided

(d) appropriate devices and techniques that will help appraise all objectives are made available.

3. Teachers' meetings and in-service programs on evaluation may be organized to help teachers:

(a) define and clarify the behavioral goals of elementary science

(b) plan and discuss appropriate activities that will carry out these goals

(c) construct tests and other devices that will give evidence of the influence of science teaching upon pupil behavior

4. An evaluation plan covering at least several if not all the grades in the school system and involving the coordinated efforts of several if not all teachers is probably a necessity for the effective attainment of behavior goals. It is likely that small gains will be attained in these objectives if only a single subject in the sixth grade program aims to achieve them. They need to be emphasized and reinforced in different parts of the curriculum simultaneously. Behavior goals are complex. Measures of a year's growth might reveal little change. They are probably attained as the product of all or at least a major portion of a child's years in school.

5. It seems that additional attention and effort need to be directed toward simplification of records without sacrificing the primary requirement that they give an accurate description of the significant reaction which took place.

6. The evaluative devices and methods of appraisal proposed in this study should probably be initiated gradually. Although it may seem desirable to evaluate a wide range of objectives, it seems wise to introduce these techniques and procedures only as rapidly as they can readily be assimilated and used by the teachers.

7. The major suggestion for additional study is the refinement and validation of the evaluative devices and procedures developed in this study. It is through trials and modifications that the effectiveness of these devices and procedures as evaluative instruments and techniques can be determined and increased.

8. Continued effort seems needed for expanding the scope of science evaluation in the elementary schools in Manila. Research needs in this phase of science instruction continue to be (1) improved procedures for identifying other significant behavior objectives and translating them into observable pupil reactions, (2) more valid, more reliable and more practical devices and techniques than those now available for assessing these behavioral objectives, (3) effective ways of integrating the results of these appraisals into a comprehensive evaluation of a pupil.

APPENDICES

APPENDIX A

EVALUATIVE DEVICES

EXPERIENCE AREA 1 - PLANTS AND ANIMALS

Unit I - Trees Around us

Unit II - Our Aquatic Animals, Their Protection and Conservation

Unit III - Our Work Animals

Unit XI - Birds and Fowls

Unit XII - Air Plants

Unit XIII - Plants for Food

Unit XIV - Useful and Harmful Insects

OBJECTIVE TESTS

I. Knowledge of Terminology

Directions: In each group below, select the numbered word or phrase which most nearly corresponds in meaning to the underlined word in the sentence.

1. We classify trees when we

   (a) describe their appearance, (b) group them according to certain characteristics, (c) protect them, (d) use them wisely.

2. Erosion takes place when

   (a) soil is washed away, (b) soil is fertilized, (c) trees are planted, (d) wild animals are killed.

3. Ornamental plants and trees are planted for the

   (a) beauty, (b) food, (c) fuel, (d) shade they give.

4. A hypothesis is

   (a) an answer, (b) a conclusion, (c) a reason, (d) a trial solution.

5. A parasite is a plant or animal that

   (a) cannot live without food, (b) causes disease, (c) cannot live by itself, (d) gets its food from the surrounding air.

6. An ornithologist studies

   (a) birds, (b) insects, (c) ornamental plants, (d) orchids.

7. A herbivorous animal eats

   (a) only plants and plant products, (b) all kinds of food, (c) meat only, (d) meat and plants.

8. An entomologist is a scientist that studies

   (a) ants, (b) birds, (c) insects, (d) trees.

9. An aquatic animal lives in the

   (a) air, (b) caves, (c) land, (d) water.

10. A vertebrate is an animal
    (a) with a backbone, (b) without a backbone, (c) with lungs,
    (d) with light organs.

II. Knowledge of specific facts, conventions, trends and sequences, classification and categories, criteria, and methodology.

A. Directions: Read each question carefully. For each question there are four possible answers. Write on your answer sheet the letter of the best answer to the statement.

1. The outside covering of trees that protect it from the weather and insects is called
   (a) bark, (b) coat, (c) peel, (d) skin.

2. Many plants are protected from animals and man by
   (a) roots and roothairs, (b) small and light seeds,
   (c) spines and thorns, (d) tough leaves and stems.

3. People plant trees and grass along hillsides in order to
   (a) attract more birds, (b) help prevent soil erosion,
   (c) provide more picnic space, (d) make the place pretty.

4. You can tell the age of a tree by
   (a) counting the rings in the trunk, (b) measuring its height, (c) measuring the circumference of the trunk, (d) measuring the thickness of the bark.

5. The bamboo is a beautiful and useful
   (a) grass, (b) palm, (c) shrub, (d) tree.

6. The process by which green plants make sugar with the help of sunlight is called
   (a) digestion, (b) photosynthosis, (c) transpiration,
   (d) trapism.

7. A "food chain" shows that
   (a) all living things get their food from green plants,
   (b) not all living things get their food from green plants,
   (c) not all green plants are used for food, (d) living things do not get all foods from green plants.

8. The energy that green plants use for making food comes from
   (a) the rain, (b) the soil, (c) the sunlight, (d) the water.

9. Plants make food with the help of the
   (a) cellulose, (c) stomates, (c) chlorophyll, (d) spores in the leaves.

10. The chemical formula for carbon dioxide is
(a) C_2O, (b) CO_2, (c) O, (d) H_2O.

11. Plants give off oxygen during
(a) osmosis, (b) photosynthesis, (c) respiration,
(d) transpiration.

12. Green plants make sugar out of hydrogen, oxygen and
(a) carbon dioxide, (b) carbon, (c) phosphorus, (d) sulphur.

13. Air enters a green leaf through openings called
(a) chlorophyll, (b) veins, (c) petiole, (d) stomates.

14. Earthworms are our friends because
(a) they eat harmful insects, (b) they eat harmful weeds,
(c) they make the soil fertile, (d) they are scavengers.

15. We fertilize the soil before planting in order to
(a) allow water to soak into the soil, (b) loosen the soil,
(c) replace used-up minerals, (d) use less water.

16. Soil with
(a) fertilizer, (b) nodules, (c) sand, (d) humus
can retain enough moisture without displacing the air in it.

17. Peanuts, beans, and other legumes are good for the soil
because they supply the soil with
(a) carbon, (b) phosphate, (c) nitrogen, (d) oxygen.

18. Mushrooms grow from
(a) spores, (b) seeds, (c) shoots, (d) bulbs.

19. Iodine is used in testing for
(a) fat, (b) protein, (c) starch, (d) sugar.

20. A plant gets the water it needs for making food through its
(a) bark, (b) leaves, (c) roots, (d) root hairs.

21. Orchids are examples of
(a) air plants, (b) non-green plants, (c) parasites,
(d) water plants.

22. The leaf of
(a) a fern, (b) a fire tree, (c) a narra, (d) an orchid
is called a frond.

23. True vanilla comes from a kind of
(a) fern, (b) ice cream, (c) orchid, (d) tree.

24. Our work animals have
(a) hoofs, (b) horseshoes, (c) horns, (d) backbones
instead of toes.

25. The legs of an insect are attached to
(a) the abdomen, (b) head, (c) thorax, (d) wings.

26. A butterfly goes through four stages as it grows
(a) 1. egg 2. larvae 3. pupa 4. adult
(b) 1. egg 2. pupa 3. larvae 4. adult
(c) 1. larvae 2. pupa 3. egg 4. adult
(d) 1. pupa 2. egg 3. larvae 4. adult

27. The nymph is one stage in the growth of a
(a) bee, (b) dragonfly, (c) housefly, (d) mosquito

28. Wrigglers are mosquito
(a) eggs, (b) larvae, (c) nymphs, (d) pupa.

29. Mosquitoes are food for
(a) cicadas, (b) aphids, (c) locusts, (d) dragonflies.

30. An example of an amphibian is the
(a) crab, (b) frog, (c) milkfish, (d) oyster.

31. A squid is
(a) an amphibian, (b) an arthropod, (c) a fish, (d) a mollusk.

32. Orchids and ferns are useful to man because
(a) they have magical powers, (b) they can substitute for some medicine, (c) they can be used as ornaments, (d) they are used for food.

33. Frogs and other amphibians are useful to man because
(a) they bring rain, (b) they are used as food, (c) they make the soil fertile, (d) they eat harmful insects.

34. Animals whose body temperature changes with the temperature of the air or water around them are
(a) cold-blooded, (b) fish, (c) invertebrates, (d) warm-blooded.

35. The gills of aquatic animals enable them to get
(a) energy, (b) food, (c) oxygen, (d) salt
from the water they live in.

36. An underwater vehicle that can move by itself not only up and down but also forward and backward is the
(a) Aqua-lung, (b) bathyscaph, (c) bathysphere, (d) flip ship.

37. The bathyscaph was designed by
(a) Barton, (b) Beebe, (c) Morse, (d) Picard.

38. All living things in the ocean depend on the
    (a) green plants, (b) small fish, (c) plankton, (d) tiny
    shells for food.

39. An underwater vehicle that can be turned up on end and used for exploration is the
    (a) bathyscaph, (b) bathysphere, (c) Aqua-lung, (d) flip
    ship.

40. The explorations of the ocean floor may lead men to the possible use of new
    (a) habitats, (b) defense bases, (c) recreation centers,
    (d) sources of food supply.

B. Identify and Describe

1. Bring pictures or photographs of trees found in the locality. Give a number to each picture and ask the children to identify each tree by writing the name of the tree after the corresponding number indicated by the picture. Ask them to write two or three distinguishing characteristics of each tree.

2. Ask children to observe carefully a tree in the schoolyard, and list all the characteristics which would be necessary to describe it to someone in a way he would recognize the tree.

3. Show the children a picture of a cow and a carabao. Ask them to describe both animals, indicating in one column their similarities and in another column their differences.

C. Directions: Put a check (✓) before each phrase or word which you think will complete the statement correctly.

1. The narra tree was selected as the national tree of the Philippines because
    (a) of its popularity.
    (b) of the legends attached to it.
    (c) of its hardiness.
    (d) of its useful fruits.
    (e) of its rapidity of growth and nativity.

2. A wise farmer interested in getting a good harvest would
    (a) select the best seeds to plant.
    (b) kill all insects.
    (c) cultivate or loosen the soil.
    (d) fertilize the soil.
    (e) plant the same crop every year.

3. The narra tree is one of our important commercial trees. Some of its distinguishing characteristics are:
    (a) a tall tree with wide spreading branches.
    (b) rough, thick, black bark.
    (c) crimson sap used as dye.
    (d) large bright red flowers.
    (e) heart wood has a great variety of color.

4. Orchids differ from other plants in some ways. Most of them
    (a) can grow without soil.
    (b) reproduce by spores.
    (c) have white fleshy roots.
    (d) do not need frequent watering.
    (e) branch out from a stem.

5. Ferns are ornamental plants. Most of them
    (a) need plenty of sunshine.
    (b) reproduce by spores.
    (c) have the tip of their young leaves coiled.
    (d) do not want to be constantly wet.
    (e) have long stems above the ground.

6. All mammals have certain characteristics in common. Some of them are.
    (a) All or part of their bodies are covered with hair.
    (b) They live on land.
    (c) They can feed their young with milk from their bodies.
    (d) All of them have backbones.
    (e) Most of them are warm-blooded.
    (f) They give birth to living young.

7. The characteristics common to all insects are.
    (a) All insects have wings.
    (b) They have six legs.
    (c) Their bodies are divided into three separate regions.
    (d) They have feelers or antennae.
    (e) They have outside skeletons.

8. Some insects that live together and share the work are
    (a) ants.
    (b) butterflies.
    (c) honeybees.
    (d) locusts.
    (e) hornets.
    (f) cockroaches.

D. 1. Directions: Complete the table given below by writing the names of other trees and plants in your locality which come under each heading (9).

Plants and Trees That Give					
Food	Clothing	Building Material	Fuel	Shade	Medicine
Mango	Abaca	Narra	Kakawati	Acacia	cinchona (dita)

2. Directions: People use much of the food that plants store. Complete the chart given below by adding at least three more examples to the one given under each heading (9).

Examples of Foods We Eat That are Stored In					
Roots	Leaves	Stems	Flowers	Fruits	Seeds
Gabi	Lettuce	Asparagus	Cauliflower	Mango	Rice

E. 1. Directions: Some characteristics of certain trees are so alike that people mistake one tree for the other. Examples of these are the cassia tree and the rain tree; the ebony tree and the camagon tree. Read the following descriptions and place an

S if the statement is true to both the cassia tree and the rain tree
C if it is true only to the cassia tree
R if it is true only to the rain tree
L if the statement is true to both the ebony tree and the camagon tree
E if it is true only to the ebony tree
C if it is true only to the camagon tree

(1) ____ a large shade tree
____ with numerous spreading branches
____ sheds its leaves in February
____ has soft yellow flowers that come in clusters
____ leaves fold up at night
(2) ____ a small tree that is not abundant
____ has more sapwood than heartwood
____ has male and female flowers on the same tree
____ heartwood is black, hard and fine grained
____ bears large round fleshy fruit that is velvety in appearance

2. Directions: Read carefully each of the statements given below. Place an

S if the statement is true to all our work animals
H if it is true only to horses
C if it is true only to cows and carabaos

____1. They eat only plant and plant products.
____2. They protect themselves from enemies by kicking and biting.
____3. Their legs and feet are adapted for walking long distances.
____4. They have a pair of hollow horns.
____5. They can carry heavy loads.
____6. They have short, strong, stocky legs.
____7. They have large, strong molars.

F. Directions. From the list of answers in Column II, select the answer which matches each item of Column I and write the letter of the answer on your answer sheet.

1.

Column I	Column II
____1. Supply the body with energy	a. Vitamin B
____2. Important for growth and repair of worn-out cells of the body	b. Phosphorus
____3. Keep blood and nerves in good health.	c. Vitamin C
____4. Necessary for healthy bones, teeth, and nails.	d. Calcium
____5. Necessary for healthy skin and eyesight.	e. Sugar and starch
	f. Vitamin K
	g. Protein

2.

Column I	Column II
____1. insect	a. shrimp
____2. mammal	b. spider
____3. arthropods	c. toad
____4. mollusk	d. horse
____5. fish	e. lapu-lapu
____6. bird	f. bee
____7. fowl	g. oyster
____8. amphibian	h. turkey
	i. maya

G. Directions: Write as many answers to each question as there are blanks under it (9).

1. How may we help birds?
   a. ____________________
   b. ____________________
   c. ____________________
   d. ____________________
   e. ____________________

2. In what ways are some birds harmful to other living things?
   a. ____________________
   b. ____________________
   c. ____________________

3. In what ways are most birds helpful to men?
   a. ____________________
   b. ____________________
   c. ____________________
   d. ____________________

H. 1. Directions: Match each name to the right phrase. Write in the blank before each phrase the number of the correct name.

____a. Webbed feet
____b. Scratching feet
____c. Talon-feet
____d. Wading feet
____e. Perching feet

1. hawk
2. maya
3. duck
4. chicken
5. heron
6. penguin

2. Directions: Read carefully each of the statements given below. If a statement is about Birds or Fowls, write "B" before the statement. If it is about Fishes and Other Aquatic Animals, write "F". If it is about Work Animals, write "W".

____a. They breathe through the gills.
____b. They have hollow bones filled with air.
____c. They have strong-padded hoofs useful for walking long distances.
____d. Some of them have fins for swimming.
____e. Their bodies are covered with hair.
____f. They have two feet.
____g. They live in shells and are therefore protected from enemies.
____h. Their bodies are protected from heat and cold by feathers.
____i. Most of them have scales and are therefore protected from enemies
____j. They have large bodies covered with thick tough skin.

3. Directions: Deep-sea fish have special adaptations that enable them to live at great depths in the ocean. Check the correct statements.

   a. Many deep-sea fish have light organs.
   b. Most of them are large and strong.
   c. They have very large mouths and sharp teeth.
   d. They have bright and attractive colors.
   e. They have large sensitive eyes.
   f. They have odd shapes.

4. Directions. Read each statement carefully. Place in Column I all the statements which tell about the shellfish or mollusk; in Column II all the statements which tell about the arthropods; in Column III all the statements which tell about the fish, and in Column IV all the statements which tell about the amphibian.

Column I	Column II	Column III	Column IV
1.	1.	1.	1.
2.	2.	2.	2.
3.	3.	3.	3.
etc.	etc.	etc.	etc.

   a. Most of them are covered with scales.
   b. They have skeletons on the outside of their body.
   c. They have tough, moist, slippery skin.
   d. They have a protective shell for body covering.
   e. They can live both on land and in water.
   f. They have a pair of antennae for feeling.
   g. They breathe with gills.
   h. They have legs that are jointed and can bend.
   i. They have soft-fleshy bodies.
   j. They breathe with gills when they are young and with lungs when they are grown.
   k. They have a special sheet of tissue called the mantle which protects the shell.
   l. They have two pairs of appendages.
   m. Most of them use fins for swimming.
   n. They crawl on land and swim in the water.
   o. Their webbed feet enable them to swim.
   p. They have more than two pairs of legs with which they crawl.
   q. They croak at night.
   r. They have claws with which they secure food.
   s. They have air bladders which enable them to rise, sink, or stay in the water.
   t. Their eyes are on stalks.

5. Directions: The following are descriptions of some common Philippine birds. Identify the bird described after each number by writing the name of the bird on the blank spaces. Select your answers from the list given below the test items.

____1. It is a huge bird with a large red bill and a loud harsh voice. It has long black eyelashes that gives its face a very wise look.

____2. Unlike other birds its eyes are in front of its head. It has stiff feathers around its eyes. It swallows its food in big lumps — bones, feathers, and all.

____3. It has red eyes and hard pretty spangles on its head and throat that sparkle like jet beads. It lays its eggs in other bird's nests and refuses to feed its own babies.

____4. They are long-lived birds noted for their ability to talk. They use their bill for a third foot and keep still and very quiet while eating.

____5. A bird with a long neck and very long legs and a bald head.

a. Parrot
b. Oriole
c. Crane
d. Calao
e. Pelican
f. Scale-feathered cuckoo
g. Woodpecker
h. Owl

I. 1. Directions: You want to set up some criteria which will help your classmates distinguish birds from other animals. Which of the following will you include in your list? Check your answers.

a. All birds are warm-blooded animals.
b. All of them have feathers.
c. All of them can fly.
d. They all hatch from eggs.
e. All of them build nests.
f. They have no teeth but have bills of the same shape.
g. They have two wings and two feet.

2. Directions: Maria wanted to buy some fish for lunch. Which of the following descriptions will help her select fresh fish?

a. limp body, silvery scales
b. firm body, red gills
c. limp body, reddish eyes
d. reddish eyes, brownish gills

J. Directions: Insects have special traits, devices, and means of protection such as those given below that help them live in their environment. Complete the chart given below by adding at least one more name under each heading.

Bite	Suck or sting	Colors that blend with environment	Enormous or sensitive eyes	Delicate hairs sensitive to sound	Foul odor	Luminous body parts
ant	bee	praying mantis	dragonfly	cricket	squash bug	firefly

K. 1. Directions: There are different ways of catching fish. Which of the following are good to use? Check your answers.

a. salambao (dip net)
b. hook and line
c. dynamite
d. salacab (trap made of bamboo)
e. baklad (corral)

2. Directions: You have learned many ways of preserving fish. One of them is by smoking. Below are the different steps in making "tinapa" (smoked fish). Number them in the proper order.

Steps in Making *Tinapa* (smoked fish)

____ The fish in the baskets are placed over arc-shaped earthen jars containing burning sawdust.
____ The fish are dipped into boiling brine; the time varies according to the species of fish.
____ Fresh fish are soaked in brine from one to four hours.
____ The fish are covered, turned several times during the smoking until reddish brown.
____ The fish are placed in baskets, single layers and allowed to drain in the sun for several hours.
____ The fish are cleaned and placed in five layers in coarse wooden baskets.

III. Knowledge of basic concepts, generalizations, principles, theories, and structures.

A. Directions: Put a check (✓) before each phrase or word which you think will complete the statement correctly (9).

1. Trees and plants store food in
   - a. the leaves
   - b. the roots
   - c. the stamens
   - d. the trunks
   - e. the pistils
   - f. the seeds
   - g. the stems
   - h. the flowers
   - i. the soils

2. There are laws to protect plants and trees
   - a. from forest rangers.
   - b. from forest fires.
   - c. from careless cutting by men.
   - d. from birds and insects.
   - e. from naughty children.

3. Trees have many enemies. They are:
   - a. fires
   - b. aquatic animals
   - c. insects
   - d. plant diseases
   - e. sunshine
   - f. man
   - g. some land animals
   - h. wind
   - i. water

4. Trees and plants on the mountainsides and along river banks
   - a. wash off the soil.
   - b. prevent floods.
   - c. use up the soil.
   - d. prevent unnecessary washing off of soil.
   - e. conserve water.

5. Trees and plants in the forests give us not only lumber for building houses, but also
   - a. forest products like rattan, gutta percha, and rubber.
   - b. birds and insects.
   - c. medicine.
   - d. clothing.
   - e. a hunting ground for wild animals.

6. Plants and animals are alike because they need
   - a. water
   - b. air
   - c. carbon dioxide
   - d. sunlight
   - e. shelter

B. Directions Read carefully each of the situations or practices given below. Write on the blank after each situation the number of the "big idea" which applies to the situation or practice (9).

1. Jose and Noel wanted to raise cabbages and mustards in their vegetable garden. They went to the nursery of the Bureau of Plant Industry to buy some good seeds. They asked the agriculturist which seeds would give them a good crop._____
2. Domingo prepares the ground of his plot very carefully. After turning and loosening the soil he gets some horse or chicken manure and mixes it with the soil._____
3. Every morning Anastacio removes the weeds in his garden. He turns and loosens the soil. ___
4. The leaves of the pechay in Gregorio's garden are full of aphids. Gregorio applies tobacco juice to kill the aphids. ____
5. Jose and Noel transplanted the mustard and cabbage seedlings in the plots leaving adequate space between the plants._____

"Big Ideas"

a. Proper cultivation and fertilization of the soil is an important factor in producing healthy plants.
b. Vegetables grow best in loamy soil.
c. Protection against harmful insects and pests are necessary for growing plants.
d. Plants grow best when they get enough sunlight, water, and minerals from the soil.
e. Selecting better seeds improves the amount and quality of plants raised.
f. Weeds compete with garden plants for minerals, water, sunlight and air.

D. 1. Directions: Read the following paragraph carefully, then answer the questions after it.

The people living on a certain mountainside cut down trees for lumber to be sold to the neighboring provinces. Soon all the trees on the mountainside were gone. What would probably happen?

Write only the number of your answer on your Answer Sheet.
a. The soil became rich and fertile.
b. The area was soon covered with trees.
c. Much soil was washed away by the rains.
d. Wild life became more abundant.

Which of the following big ideas of science gives the best explanation of what you think happened? Write only the number of your answer.
a. Trees prevent floods.
b. Trees use up the soil.
c. Animals like to live in clear areas.
d. It does not take long to grow trees.
e. Trees help prevent soil erosion.

2. Directions: Write in the blank before each story the number of the generalization which pertains to the story (9).

____1. Mariano goes out in the evening to catch fish. He has a hook and line. He gathers earthworms for his bait. He carries a lamp so that he may see his way. At other times, he uses a bamboo trap called "salacab." When he goes out in a banca, he uses a dip net.

____2. Mang Tasio is a good fisherman. Every day he has a big catch. When he finds small fish in his catch, he returns them at once to the water.

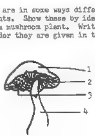
____3. Government officers caught some fisherman off the coast of Bataan catching fish with dynamite. The officers came in motor boats. They took the men to the municipal jail.

____4. Before the rainy season comes, Aling Maria buys hundreds of catfish and some other seasonal fish. She salts them and dries them in the sun. She smokes the rest.

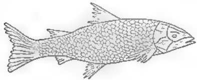
Generalizations

a. Fish may be conserved through proper ways of fishing.
b. Fish may be preserved by salting, drying, and smoking.
c. The government enforces laws and other measures to help conserve our fish resources.
d. There are different ways of catching fish.
e. Most aquatic animals are good food for man.
f. Aquatic animals should be protected from their enemies.

D. 1. Directions: Mushrooms are in some ways different from green plants. Show these by identifying the parts of a mushroom plant. Write your answers in the order they are given in the illustration.



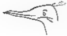
2. Directions: (a) A fish breathes through the ______. Show by an arrow (⟶) where this part of the fish is found (9).



(b) Check which part helps the fish to push up and down.

(c) Show by an arrow (⟶) the scales.

E.



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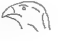

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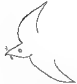


5

6

Directions: You have learned that birds have different kinds of beaks, depending on the kind of food they eat. Supply the data called for in each of the columns given below. Follow the example given (27).

	Type of Beak	Illustration No.	How Used	Example
a.	Cracking beak	6	cracking seeds or grains	chicken
b.	Tearing beak			
c.	Spearing beak			
d.	Digging beak			
e.	Straining beak			
f.	Insect catching beak			

F. Directions. Go over the items given under each column carefully. Find out which items listed under Column II are related to each of the items given under Column I. Write the corresponding letters on the blank spaces. Follow the examples given.

Examples:

____1. factory
____2. leather
____3. shoes

a. sugar
b. green leaves
c. carbon dioxide and water

Column I

____1. hoofs
____2. gills
____3. sunlight
____4. wings
____5. stomates
____6. spores
____7. feathers
____8. beaks
____9. beehive
____10. tentacles

Column II

a. fins
b. electricity
c. antennae
d. seeds
e. toes
f. chlorophyll
g. ant hill
h. lungs
i. teeth
j. nose
k. arms
l. scales

IV. Testing for the ability to think critically and solve problems scientifically

A. Interpretation

Directions. Read the paragraphs carefully, then answer the questions below it.

1. All the energy that enables you to live and grow comes from plants. You get some of it by eating plants. You get the rest by eating food from animals that ate plants. The source of human energy is in a plant.

On the blank spaces before each number write.

A if the facts given in the paragraph definitely show that the item correctly completes the beginning statement

B if the facts given in the paragraph do not definitely show that the item correctly completes the beginning statement

Your body would not have energy

____1. if there were no plants.

____2. if you did not eat food from animals.

____3. if you did not eat plants.

2. The Pride of Mindanao (9)

One of the most famous Philippine orchids grows wild in Davao, Mindanao. It is the Waling-Waling. This orchid has very attractive flowers. The flowers grow in clusters with as many as fifteen in a cluster. The flowers are pink and have yellow streaks. The leaves are large, hard, and stiff. This orchid is hard to grow. The white Waling-Waling, another variety, is hard to find.

After the number on the answer sheet corresponding to that of each statement write.

A if the information given in the paragraph is sufficient for you to think that the statement is definitely true

B if the information given in the paragraph is sufficient only to indicate that the statement is probably true

C if the information given in the paragraph is not sufficient to indicate any truth or falsity in the statement

D if the information given in the paragraph is sufficient for you to think that the statement is probably false

E if the information given in the paragraph is sufficient for you to think that the statement is definitely false

____1. The Waling-Waling has fragrant flowers.
____2. There are more than one variety of Waling-Waling.
____3. The Waling-Waling is a beautiful but expensive orchid.
____4. The Waling-Waling and the Sampagnita are the same in the way their flowers grow.
____5. You cannot have more then one flower from each Waling-Waling plant each year.

B. Determining if a statement can be verified scientifically

Directions: For each of the statements listed below write:
A if the statement can be scientifically verified
B if the statement is an accepted theory and hence need not be scientifically verified
C if the statement contains a value judgment and hence cannot be scientifically verified
D if the statement is a definition and needs no further verification

____1. Shade trees are more needed along public highways than ornamental plants.
____2. Plants need air in order to live.
____3. Non-green plants cannot make their own food.
____4. The stomata are the openings on the surface of leaves through which air passes.

C. Recognizing a problem, recognizing hypotheses and selecting methods of testing them, critically evaluating experimental procedures, data, conclusions, and implications.

Directions. Read the paragraph carefully, then answer the questions following it.

1. A Grade VI class at the Rizal Elementary School was interested in plants and trees. 2. Mr. Mendoza, the principal, gave the children a part of the school garden to study plant life. 3. The children wanted to know the effect fertilizer has on green plants. 4. Someone suggested that they read a book about plants. 5. Another proposed that they consult the garden teacher or try experimenting with plants. 6. The class decided to do the experiment. 7. They put some soil from the school garden in two boxes. 8. To the first box they added natural fertilizer (horse manure). 9. To the second box they added some chemical fertilizer. 10. In each box they planted ten patani (bean) seeds. 11. In a few days the seeds began to grow. 12. The children watered each box with the same amount of water.

(1) Which of the sentences in the paragraph constitute a problem? Write the number of the sentence.
(2) (a) Which sentences tell the solutions suggested to solve the problem? Write the number of the sentences.
(b) Which sentences tell what the children did to solve their problem? Write the number of the sentences.
(c) Which of the following will best tell the children's reason for doing the experiment? Write the number of the statement.
(1) Doing an experiment is fun.
(2) Doing some experiments will make them scientists in the future.
(3) The experiment will help them know the effect of fertilizer on the growth of green plants.
(4) The experiment will help soil drainage.

3. (a) What is missing in the experiment? Write the number of the correct answer.
(1) A box of soil with both natural and chemical fertilizer planted with ten patani seeds.
(2) A box of soil without patani seeds.
(3) A box of soil without fertilizer planted with ten patani seeds.
(4) A box of soil planted with different kinds of seeds.
(b) Which of the following will help the children make a good conclusion? Write the number of the statement.
(1) The color of the soil.
(2) The nature of the plants growing in each box.
(3) The amount of water needed to keep the soil moist.
(4) The amount of sunshine needed by the plants.
(c) Which of the following may the children do to verify their conclusion? Write the number of your answers.
(1) Read books about green plants.
(2) Collect different kinds of seeds.
(3) Repeat the experiment.
(4) Consult the guidance teacher.

D. Appraising real situations

Mang Berto, the school gardener, transferred some banana plants to another part of the schoolyard. He pruned the leaves before digging out the plants. Why did he do this?

1. To reduce the bulk of the banana plants.
2. To give the plants a better appearance.
3. To reduce transpiration.
4. To help the plants get more minerals from the soil.

E. Formulating a reasonable generalization

1. Directions: Read the paragraph carefully, then answer briefly the questions following it.

Pepito got three large jars of equal size. He filled the first one with stones, the second one with water, and the last one with soil. He placed them side by side in a place where they can get enough sunlight. Then he planted six bean seedlings in each jar and watered them each day. After several weeks the seedlings in the containers with the water and the stones died. Those in the container with the soil grew. Why?

2. Directions. On your answer sheet, write only the letter of the correct answer for items 1 through 3. Then write briefly on your answer sheet your plans for the experiment called for in item 4.

1. When we say a bird is dressing its feathers we mean the bird is
    (a) growing a brighter shade of feathers.
    (b) shedding off its old feathers.
    (c) spreading oil over the outer feathers.
    (d) washing its dirty feathers.

2. Why does a bird do this (dresses its feathers)?
    (a) to be able to attract other birds
    (b) to have stronger feathers which it needs for flying
    (c) to protect its feathers from getting wet
    (d) birds are by nature clean creatures

3. It is important for birds to dress their feathers because
    (a) birds with bright colors attract other birds.
    (b) new feathers make strong wings and strong wings are important in flying.
    (c) wet things are heavier and weight is important in flying.
    (d) birds are not resistant to diseases so they must be always clean.

4. Plan an experiment to prove part of your answer in item 3.

F. Applying principles to new situations

After a heavy rain, the school garden was under water for two days. Several trees and plants died. Why?

G. Planning an experiment which can be used to determine whether or not a proposed hypothesis is true

Plan an experiment to show that plants produce and store starch.

H. Deciding the order of importance of given facts

Directions: Select the items which are necessary to make the statement complete. Number them in the order of importance. Leave out any incorrect items.

Plants and trees are important to men because

____ they beautify our surroundings.
____ they give us materials to build our houses.
____ they give us shade.
____ they make the winds.
____ they give us food.
____ they give us materials for making furniture.
____ they bring us good luck.

I. Recognizing causal relationships

Directions: Below are listed pairs of events. In the blank space between the two events write:
A if the first event is the cause or contributing cause of the second event
B if the first event is the effect or result of the second event
C if there is no cause and effect relationship

First Event		Second Event
1. Trees help water to be absorbed by the soil.	____	Water is conserved.
2. Light energy is changed to chemical energy.	____	Sunlight shines on the leaves of green plants.
3. A mango tree is planted during full moon.	____	The tree bore plenty of mangoes.
4. Gullies and ditches are formed.	____	Water flows down a barren hill.
5. A cow eats grass.	____	The cow gives milk.
6. Many died of malaria fever.	____	Men, soldiers were bitten by anopheles mosquitoes during the war.

Essay Tests

1. Evaluative recall
   - a. (1) Why Trees Are Important to Us
     - (2) How Trees Help Men and Animals
     - (3) If There Were No Trees
   - b. How Our Work Animals Help Us

2. Selective recall
   - a. What are some of the uses of orchids and ferns?
   - b. What are the importance of aquatic animals?

3. Explanation of the meaning of some terms or phrases
   - a. Describe in your own words the process of photosynthesis.

4. Classification
   - a. How will you classify trees according to use?

5. Application of rules or principles
   - a. If you were transplanting a young plant from one side of the yard to another, what would you remember to do? Why?

6. Discussion
   - a. Discuss how plants store food.
   - b. Discuss what you can do to protect and conserve trees and other plants.
   - c. Play you are writing an article for the Society for the Prevention of Cruelty to Animals Tell your readers the needs and proper care of our work animals.

7. Criticism
   - a. What is wrong with this menu? Write what you think.
     - Boiled rice
     - Fried chicken
     - Fried potatoes
     - Ice Cream
     - Cake

8. Outline
   - a. Outline the steps in making paper out of wood.
   - b. How will you preserve fish by drying? Outline the steps.

9. Analysis
   - a. How do orchids differ from other green plants?
   - b. What special adaptations of amphibians enable them to live both on land and in water?

10. Explanation
    - a. Explain how you will take care of orchids and ferns.
    - b. Why do we celebrate "Bird and Arbor Day"?

11. Comparison
    a. Compare a bird with a fish as to characteristics and usefulness to man.
    b. Compare mollusks with arthropods as to characteristics and structure.

12. Causes and Effects
    a. Why some insects should be protected and others destroyed and controlled.
    b. Why is the government prohibiting the use of dynamite in fishing?

Non-Testing Procedures

A. 1. Try to contribute something towards the propagation, protection, and conservation of trees in your locality. Keep a record of what you have done in this regard, indicating the date the activity was undertaken and the beneficial result that comes or will come out of the activity. Discuss what you have done with your teacher and classmates (9).

   2. Evaluating garden practices

   Recall the different activities you undertook in connection with the garden project, and answer the following questions with Yes or No (9).

   a. Did you dig the soil deep enough?
   b. Did you mix fertilizer with the soil?
   c. Did you select properly the seeds you planted?
   d. Did you plant them at proper distances?
   e. Did you loosen the soil frequently?
   f. Did you protect the plants from insect pests?
   g. Did you put trellises when needed?
   h. Did you harvest at the proper time?

   3. Make a list of the co-curricular activities you actively participate in. (Take note of the children who actively participate in campaigns such as "Keep Your Community Green," or "Help Our Trees and Plants Grow" undertaken by the school or by civic organizations.

   4. Directions. The following is a list of desirable activities that you can do to help protect and conserve useful birds and fowls. Check those that you have done or habitually do (9).

   a. Building a birdhouse.
   b. Protecting the nests of birds.
   c. Avoiding shooting at birds.
   d. Preventing other children from shooting at birds.

e. Feeding and giving water to home fowls regularly.
f. Avoiding playing with birds and fowls in a manner that will hurt them.
g. Letting birds and fowls lay and hatch their eggs in their nests without disturbing them.
h. Protecting young fowls from rats, pigs, and other enemies.
i. Avoiding throwing stones or anything that hurts chickens and other fowls.
j. Providing facilities, such as water to bathe in, sheds to rest in, etc., to make home fowls live comfortably.

5. Keep a record of all the things that you do or have done to protect useful insects and those that you do or have done to destroy harmful insects.

B. 1. Take the children on field trips to places of natural beauty and observe their behavior. See how many children refrain from (1) injuring the bark of trees, (2) picking flowers and breaking the branches of trees, (3) climbing and picking fruits from trees, and (4) playing in such a way that they do not break the branches of trees or hedges.

2. See the exhibits put up by the children on "Trees and Their Uses." Determine if they show evidence of children's knowledge of the uses and importance of trees.

C. Directions: Below are statements concerning some practices. If you agree with the practice stated circle A; if you disagree circle D, if you are uncertain circle the U.

A U D 1. A cochero was fined for using a horse with wounds on its front legs.
A U D 2. A young carabao was butchered at the slaughter house for its meat.
A U D 3. During hot dry months forest areas are closed to hunters and campers.
A U D 4. Some people use orchid plants for emetic, to expel tapeworm, and in the treatment of skin infection.
A U D 5. Violators of our forest and fishing laws are heavily penalized.
A U D 6. Some people use insecticides and other devices to destroy and kill all insects.
A U D 7. The government prohibits the use of dynamite in fishing.

APPENDIX B

EVALUATIVE DEVICES

EXPERIENCE AREA 2 - THE WEATHER

Unit IV - Air and Its Importance to Life

Objective Tests

I. Knowledge of terminology

Directions. In each item below, select the work or phrase which most nearly corresponds in meaning to the description given at the beginning of each statement. Write only the letter of the correct answer.

1. The condition of the atmosphere at a given time is what we call (a) climate, (b) humidity, (c) temperature, (d) weather.

2. The amount of water vapor or moisture in the air is (a) clouds, (b) evaporation, (c) humidity, (d) steam.

3. The region of the earth's atmosphere nearest land and water surfaces is called (a) ionosphere, (b) stratosphere, (c) thermosphere, (d) troposphere.

4. An instrument that tells us how heavily the air presses is (a) anemometer, (b) barometer, (c) galvanometer, (d) thermometer.

5. Liquid water that has changed to gaseous water is called (a) clouds, (b) moisture, (c) dew, (d) water vapor.

6. The general condition of the weather at any place on earth is (a) atmosphere, (b) climate, (c) environment, (d) temperature.

7. A whirling wind with speeds up to 500 miles an hour is (a) an air current, (b) typhoon, (c) tornado, (d) storm.

8. A tropical storm formed in the Pacific Ocean in the Philippines is (a) a hurricane, (b) tornado, (c) typhoon, (d) thunderstorm.

9. The upward force created when the pressure below the wing of an airplane is greater than above the wing is called (a) drag, (b) thrust, (c) gravity, (d) lift.

10. A large body of air that has about the same temperature and moisture is called (a) an air mass, (b) cloud, (c) wind, (d) smoke.

II. Knowledge of specific facts, conventions, trends and sequences, classification and categories, criteria, and methodology.

A. Directions: Read each question carefully. For each question there are four possible answers. Write on your answer sheet the letter of the best answer to the statement.

1. Cold air is
   (a) heavier than, (b) lighter than, (c) as light as, (d) as heavy as warm air.

2. Air that is heated
   (a) contracts, (b) expands, (c) liquifies, (d) solidifies.

3. A mass of water droplets in the atmosphere is called
   (a) cloud, (b) draft, (c) storm, (d) wind.

4. The "eye" of the storm is the
   (a) direction the strong winds are taking, (b) low pressure center, (c) high pressure center, (d) voluminous rains released.

5. An instrument which measures the speed of wind is the
   (a) anemometer, (b) barometer, (c) galvanometer, (d) hygrometer.

6. A low gray cloud which brings rain is called
   (a) cirrus, (b) cumulus, (c) nimbus, (d) stratus.

7. Land areas will be
   (a) rapid to warm up and rapid to cool off
   (b) slow to warm up and slow to cool off
   (c) rapid to warm up and slow to cool off
   (d) slow to warm up and rapid to cool off

8. During the dry season, air coming from the sea is cooler than air over the land because
   (a) bodies of water do not absorb heat coming from the sun
   (b) land areas warm up more rapidly than bodies of water
   (c) air above the surface of bodies of water move rapidly than air over land areas
   (d) air over land areas does not circulate

9. Tropical storms are classified according to
   (a) the areas they come from, (b) direction the winds take, (c) the maximum wind speed associated with them, (d) volume of rains released.

10. Most typhoons in the Philippines form during the months of
    (a) October, November, December (b) June, July, August
    (b) April, May, June (d) July, August, September

11. Large fluffy white clouds with domes top and flat bottom are called
    (a) cirrus, (b) cumulus, (c) nimbus, (d) stratus.

12. The instrument used to measure the temperature of the atmosphere is called
    (a) anemometer, (b) barometer, (c) thermometer, (d) Fahrenheit.

13. The air that surrounds the earth is called
    (a) atmosphere, (b) clouds, (c) mass, (d) winds.

14. The two types of monsoon winds in the Philippines are
    (a) Northeast and Southwest monsoons
    (b) Southeast and Northwest monsoons
    (c) North and South monsoons
    (d) East and West monsoons

15. The strongest winds are associated with
    (a) tropical storms, (b) depression, (c) typhoon, (d) tornado.

B. Directions: The terms given in Column I are used to describe weather and weather disturbances. Show what they mean by matching them with the descriptions given under Column II.

Column I	Column II
a. Fine weather	____1. Rain would occur during a greater portion of the day.
b. Fair weather	____2. Another name for typhoon.
c. Rainy weather	____3. Few clouds, no rain.
d. Stormy weather	____4. Heavy rains accompanied by lightning and thunder.
e. Tropical cyclones	____5. Clouds may produce rain in scattered patches; the greater portion of the day is sunny.
f. Thunderstorms	____6. Rain accompanied by strongwinds.
g. Hurricane	____7. Voluminous rains accompanied by strong winds.

III. Knowledge of basic concepts, generalizations, principles, and theories.

A. Directions: Read the situation carefully and select the characteristic of air, concept or principle you have learned that is involved in it. Write the letter of the correct answer on your Answer Sheet.

1. Lito placed a dragonfly in a small glass jar and tightly sealed it so that it cannot escape. After several hours the insect died. Why?
   (a) Air occupies space.
   (b) Living things need air in order to live.
   (c) Living things need light in order to live.
   (d) Air exerts pressure.

2. Carmen boiled some water in a pot. Sometime before it was ready to boil, bubbles came out of the water. Something is escaping from the water.
   (a) There is water in the air.
   (b) Air occupies space.
   (c) Air exerts pressure.
   (d) There is air in the water.

3. Place a self-filling fountain pen into a bottle of ink. The ink rises in the pen after you release the lever.
   (a) Air exerts pressure. (c) Air has weight.
   (b) Air moves things. (d) There is air in water.

4. Weigh a volleyball before pumping air into it. Weigh it after filling it with air. The ball is heavier.
   (a) Air occupies space. (c) Air exerts pressure.
   (b) Air has weight. (d) There is water in air.

5. The leaves and branches of trees are moving. The tall grasses are bending. Pieces of paper and dry leaves are being blown here and there.
   (a) Air can move things. (c) Air has weight.
   (b) Air exerts pressure. (d) We can't see air.

B. Directions: Put a check (✓) before each phrase or word which you think will complete the statement correctly.

1. Typhoon warning signals are given as
   (a) Signal number 1, 2, 3
   (b) Red, White, and blue
   (c) A, B, C
   (d) Weak, Strong, Dangerous
   (e) One blast, two blasts, three blasts

2. Girls' names have been used by the Weather Bureau to identify tropical storms because
   (a) typhoons are as unpredictable as women.
   (b) girls' names are short and quickly recognized.
   (c) girls' names are prettier than number or letter names.
   (d) girls. names are clearly pronounced thus less subject to error.
   (e) girls' names are easily remembered.

3. Weather is the result of changes in the atmosphere which are brought about by
   (a) heat (d) winds
   (b) pressure (e) moisture
   (c) clouds

4. Some important gases found in the air are
    (a) nitrogen
    (b) carbon
    (c) hydrogen
    (d) oxygen
    (e) iodine

5. We cannot see air yet we know there is air because
    (a) we can feel it
    (b) it moves things
    (c) it makes food
    (d) it occupies space
    (e) it exerts pressure

IV. Tests for critical or scientific thinking and solving problems scientifically.

A. Translation from one level of abstraction to another
Directions: Put a check ( ) before each phrase which you think will complete the statement correctly.

1. The principle of air pressure is illustrated by
    (a) the cooling effect of moving air
    (b) drinking through a straw.
    (c) the burning of a candle.
    (d) the drying of wet clothes.

2. That there is water in the air is illustrated by
    (a) the bubbles coming out of the soil.
    (b) the big waves in the sea.
    (c) the bubbles formed when we boil water.
    (d) the moisture left on the cold surface of a drinking glass with ice water.

B. Interpretation
Directions: Read the paragraph carefully. Then write on the blank spaces before each number:
A if the facts given in the paragraph definitely show that the item correctly completes the beginning statement
B if the facts given in the paragraph do not definitely show that the item correctly completes the beginning statement

A cold front is a weather disturbance characteristic of the temperate regions. It is a narrow region which separates the cold air mass from the North and the warm air mass from the South. Such a dividing region produces great amounts of rainfall in the temperate regions.

A cold front is a weather disturbance
___(1) that is commonly found in the Philippines and other tropical regions.
___(2) which carries much rain.
___(3) which is caused by the cooling of the warm air coming from the southern temperate regions.

C. Application

Story problem: On a hot afternoon Linda placed some ice cubes in a drinking glass and filled it three-fourths full with orange juice. In a few minutes she saw water on the outside surface of the drinking glass. Where did the water come from?

Directions: Choose the conclusion which you think is most consistent with the facts given above and reasonable in the light of whatever knowledge you may have. Put a circle around the letter indicating your answer.

A - From the orange juice inside the glass.
B - From the melting ice inside the glass.
C - From the air around the glass.
D - It's some kind of magic and cannot be explained.

Directions: Choose the reasons you would use to explain or support your conclusion by putting a check before the letter of the correct answer.

Reasons:

(a) When liquids get cold they can penetrate through glass.
(b) Orange juice tends to separate from ice water.
(c) The warm air around the drinking glass absorbs some of the cold liquid inside.
(d) As the drinking glass cools, it contracts and gives off some of the liquid inside.
(e) When warm air is cooled, it can no longer hold as much moisture as when it was warm. The moisture is deposited on the surface of the drinking glass.
(f) There are things that happen which we can never understand.

D. Proving certain generalizations

Directions. Give an example of each of the following generalizations or basic understandings. Write your example under the generalization (9).

Example: There is air in our bodies.

Put your hand just below your nose and exhale. You will feel the air from your nose. It comes from your lungs.

1. We can feel the air but we cannot see it.
Example.
2. There is air in the soil.
Example:
3. Air is necessary to make fire.
Example:

4. Wind pushes on things.
   Example:
5. We use air in many ways.
   Example:

E. Formulating and supporting conclusions

Story problem: Nena wanted something to drink She got a can of pineapple juice and with the help of a can opener punched a hole in the top of the can. She turned the can on its side and tried to pour the juice into her drinking glass. No juice would come out. "What could be wring?" she thought.

If you were to help Nena with her problem, what would you do? To help you decide what to do, answer the following questions.

Directions: On the line after each question write the correct answer.

1. Is air needed to help liquid flow out of a container?
   ____
2. How many holes or openings are needed? ____________
3. Will air entering the can exert pressure on the liquid?
   ____
4. How will you turn the can in pouring out the liquid?
   ____

Based on your answers above, what would you do if you were Nena? Write your answer.

F. Extrapolation

Directions The graph below shows the records some scientists made of temperature at ground level and at every inch above ground for 12 inches. They made their measurements during a sunny day and also at night (28).

After the number on the answer sheet corresponding to that of each statement, write:

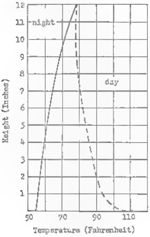
A if the information given in the chart is sufficient for you to think that the statement is definitely true.

B if the information given in the chart is sufficient only to indicate that the statement is probably true.

C if the information given in the chart is not sufficient to indicate any truth or falsity in the statement.

D if the information given in the chart is sufficient for you to think that the statement is probably false.

if the information given in the chart is sufficient for you to think that the statement is definitely false



______1. During the day the air nearest the ground is cooler than the air twelve inches above the ground.
______2. The records of the day temperature shown in the graph must have been taken during a sunny day in summer.
______3. The differences in temperature of the air at different levels must be due to the heat coming from the ground.
______4. The ground affects the temperature of the air above it.
______5. At night the temperature of the air five inches above the ground is cooler than the temperature of the air ten inches above the ground.

_______6. The temperature of the air duing the day was taken at different hours of the day.

G. Understanding causes and effect relationships

Directions: Each item below consists of a description of a pair of events. The first statement is presumably a cause of the second. After reading each item, choose which one of the three relationships given below exists between the parts of the pair of events. Encircle:

A if the first is practically the sole cause of the second

B if the first is one of a number of important contributing causes of the second

C if the first bears no causal relationship to the second

A B C 1. Air pressure changes. // The weather changes.
A B C 2. The wind blows. // Leaves of trees move; pieces of paper flutter.
A B C 3. One goes higher into the atmosphere. // The air pressure decreases.
A B C 4. Frogs croak. // It begins to rain.
A B C 5. Cool air comes in contact with warm land. // Heat energy goes into the atmosphere.
A B C 6. The open end of a balloon filled with air is released. // The balloon moves in the opposite direction.
A B C 7. The land cools faster than the body of water near it. // Air moves from land to sea.
A B C 8. The speed of an airplane's engine is increased. // The airplane goes higher.

V. Tests for evaluating the ability to observe accurately

A. Directions: Before the demonstration give the class the following oral instruction:

> A person is said to be observant when he is conscious of what is happening about him or what goes on in situations which he meets. Today we want to study your ability to see what goes on in a situation. I will perform an easy demonstration. When I have completed the demonstration you will be given an opportunity to write down the different things which I did and which took place during the demonstration.
>
> Then start the following demonstration.

Experiment: To show that air exerts pressure (20).

Put some water in a teakettle, being careful not to fill it above the spout. When steam is coming from the teakettle spout, invert a milkbottle over the spout. Leave it for about a minute. Hold the bottle with a towel and remove it from the spout; lowering it quickly, mouth down, into a pan of water. As the hot air in the bottle cools, the water will rise in the bottle.

After the demonstration ask the children to answer the following questions in writing.

1. How much water was put in the teakettle?
    (a) Enough to fill the teakettle to the brim.
    (b) Just enough to fill it above the spout.
    (c) Just enough to fill it below the spout.
    (d) About a cup full of water.

2. When was the bottle placed over the spout?
    (a) After filling the kettle with water.
    (b) Before the water began to boil.
    (c) When steam began to come out from the kettle.
    (d) After the water cooled off.

3. After inverting the bottle over the spout, what did the teacher do?
    (a) Poured some water into the teakettle.
    (b) Removed the bottle immediately from the spout.
    (c) Allowed the bottle to stay over the spout for about one minute.
    (d) Allowed the bottle to cool.

4. As the bottle cools
    (a) the level of water in the pan rose.
    (b) the level of water in the pan fell.
    (c) the level of water in the pan remained the same.
    (d) the water in the pan evaporated.

Essay Tests

1. Selective recall
   How does the Weather Bureau help us?

2. Explanation
   Explain in your own words the work of the Weather Bureau.

3. Discussion
   The Weather Bureau uses different methods of locating storms. Discuss some of them.

4. Evaluative recall
   Why is air important to all living things?

APPENDIX C

EVALUATIVE DEVICES

EXPERIENCE AREA 3 - THE EARTH AND BEYOND

Unit VI - The Universe, Our Solar System

Experience Area 3 - Earth and Beyond

Objective Tests

I. Knowledge of terminology

Directions: In the items below, select the numbered word or phrase which most nearly corresponds in meaning to the underlined word at the head of that group, and put its letter in the parenthesis at the right.

1. Sun's corona: ( )
   (a) the whirling hot gases in the center of the sun
   (b) the orbit the sun takes
   (c) the ring of light around the sun
   (d) the sun's average distance from the planets

2. Earth's orbit: ( )
   (a) the amount of time it takes the earth to go around the sun
   (b) the amount of time it takes the earth to rotate once on its axis
   (c) the earth's distance from the sun
   (d) the path it takes around the sun

3. Satellite: ( )
   (a) a small body that moves around a planet
   (b) another name for planetoid
   (c) a small star
   (d) any vehicle in space

4. Light year: ( )
   (a) a year in which a solar eclipse occurred
   (b) the distance that light travels in one year
   (c) the amount of light given by stars
   (d) the speed with which light travels in one year

5. Gravity: ( )
   (a) another word for magnetism
   (b) the path taken by a planet around the sun
   (c) the pull of the earth
   (d) the distance one can jump

6. Moonlight: ( )
   (a) reflected light from the earth
   (b) reflected light from other planets
   (c) heat energy coming from the moon
   (d) reflected sunlight

7. Sunspots: ( )
   (a) dark patches on the sun's surface
   (b) dark patches on the earth caused by sunlight
   (c) shadow of the sun on the moon
   (d) spots left by the sun on its orbit

8. Phases of the moon: ( )
   (a) changes in the lighted part of the moon
   (b) the man's face in the moon
   (c) mountains and craters in the moon
   (d) pull of the moon

9. Constellation. ( )
   (a) groups of galaxies
   (b) the sun's system
   (c) the brightest star
   (d) a group of stars

10. Rotation: ( )
   (a) movement of the earth around the sun
   (b) movement of the sun in its orbit
   (c) turning of a body on its axis
   (d) motion of the moon around the earth

11. Revolution: ( )
   (a) movement of the moon around the earth
   (b) turning of the earth around its axis
   (c) movement of the earth and other planets around the sun
   (d) movement of the solar system in the universe

12. Astronomer: ( )
   (a) an expert in the study of heavenly bodies
   (b) an expert in the study of living things
   (c) an expert in the study of telescopes and other machines
   (d) an expert in fortune telling

13. Eclipse: ( )
   (a) the dark patches on the moon's surface
   (b) the sun's shadow on either the moon or the earth
   (c) the darkening of a heavenly body by the shadow of another
   (d) the straight line formed by the sun, the moon, and the earth

14. Tide. ( )
   (a) the pull of the moon on the earth
   (b) the liquid part of the earth
   (c) the pull of the earth on the moon
   (d) the regular rise and fall of the water on earth

15. Universe: ( )
    - (a) the sun, all the planets and heavenly bodies that revolve around it
    - (b) the Milky Way
    - (c) the earth and the atmosphere around it
    - (d) the solar system and everything there is in outer space

II. Knowledge of specific facts, conventions, trends and sequences, classification and categories, criteria and methodology

A. Directions: Read each question carefully. For each question there are four possible answers. Write on your answer sheet the letter of the best answer to the statement.

1. Our sun is a (a) galaxy, (b) planet, (c) star, (d) system.
2. An example of a planet is (a) the earth, (b, Orion, (c) the moon, (d) the sun.
3. Ursa Minor is (a) a star, (b) a meteor, (c) a sun, (d) a constellation.
4. The earth's gravitational pull upon the human body is expressed as (a) one g, (b) one gram, (c) one pound, (d) g.p.
5. The distance that light travels in one year is expressed in units known as (a) solar year, (b) radar, (c) starlight, (d) light year.
6. A bright heavenly body with a tail of light and moves around the sun in a big oval course is (a) a meteor, (b) a comet, (c) a planetoid, (d) a planet.
7. A mass of stone or metal that has fallen to the earth from outer space is (a) an asteroid, (b) a meteor, (c, a comet, (d) a meteorite.
8. A good way of looking at the sun during a solar eclipse is by the use of (a) smoked glass, (b) clear glass, (c) our naked eyes, (d) binoculars.
9. About the end of the second week after the new moon (a) a full moon appears, (b) the first quarter appears, (c) the old cresent appears, (d) the new gibbons appear.
10. The earth is about (a) 75,000,000, (b) 39,000,000, (c) 93,000, (d) 93,000,000 miles away from the sun.
11. The earth rotates on its axis once every (a) 24 hours, (b) 12 hours, (c) $365\frac{1}{4}$ days, (d) $29\frac{1}{2}$ days.
12. It takes the earth one year to (a) revolve half-way around the sun, (b) rotate on its axis once, (c) revolve around the moon, (d) revolve around the sun.
13. An illustration of the solar system will show (a) earth, (b, the moon, (c) the sun, (d) a constellation near the center of it.
14. Sunspots are believed to interfere with (a) the movement of the planets around the sun, (b) the movement of the satellites around the planets, (c) radar, radio, and television transmission, (d) the force of attraction between the earth and the sun.

15. The planets traveling around the sun (a) shine with their own lights, (b) shine with reflected light from the sun, (c) shine with reflected light from their own satellites, (d) do not shine at all.
16. Each satellite (a) does not follow a definite orbit, (b) travels in the same orbit as its planet, (c) follows the orbit of the sun, (d) travels in its own orbit.
17. The moon moves around the earth once in about (a) 7 days, (b) 29 days, (c) 365 days, (d) 24 hours.
18. Scientists study planets and other heavenly bodies with the help of powerful (a) binoculars, (b) microscopes, (c) spectroscopes, (d) telescopes.
19. The main source of energy on the earth is (a) electricity, (b) the sun, (c) the oceans and waterfalls, (d) the moon.
20. The closest star to the earth is (a) Sirius, (b) the North Star, (c) the sun, (d) Rigil.

B. Directions. Match the items under Column I with those given under Column II. Write only the letters of the correct answers on your answer sheet.

1.

Column I	Column II
a. Jupiter	____1. Closest planet to the sun.
b. Uranus	____2. Appears as "evening star" after sunset.
c. Neptune	____3. Earth's closest neighbor.
d. Mercury	____4. Largest planet.
e. Pluto	____5. A planet surrounded by three rings.
f. Mars	____6. A planet which rotates on an almost horizontal axis.
g. Saturn	____7. Most recently discovered planet.
h. Venus	____8. A planet accidentally discovered by scientists who were observing Uranus.
i. Earth	

2.

Column I	Column II
a. meteor	____1. Little planets that revolve between the orbits of Mars and Jupiter.
b. constellation	____2. Its tail spreads across the sky like long flowing hair.
c. planetoids	____3. They make a bright light when they fall into the earth's atmosphere.
d. Milky Way	____4. A group of stars.
e. Polaris	____5. Our galaxy.
f. comet	____6. North Star.
g. Sirius	____7. Brightest star in the sky.
h. meteorites	

III. Knowledge of basic concepts, generalizations, and principles

A. Directions. Read each of the situations given below then answer the questions given after them. Write only the letters indicating your answers.

1. When a stone is thrown straight up in the air, it will fall back to the ground because
   (a) the stone is hard.
   (b) all things on earth are attracted or pulled toward the center of the earth.
   (c) the stone is heavy.
   (d) air is light.

2. When the sun and the moon are on the same side of the earth there are unusually high tides because
   (a) the sun and the moon attract each other.
   (b) the moon covers the light from the sun.
   (c) both the sun and the moon pull on the earth.
   (d) the earth does not get heat from the sun.

3. Although the earth rotates at a speed of about 1,000 miles per hour on its surface, objects on it are not thrown off because
   (a) the moon pulls on the earth.
   (b) the earth is pulled by the sun in its orbit.
   (c) the earth rotates around its axis while moving around the sun.
   (d) the earth pulls everything toward its center.

4. The light of the moon is neither very bright nor very hot because
   (a) the moon is not made of hot gases.
   (b) there is no air nor water in the moon.
   (c) the moon has no light of its own but gets its light from the sun.
   (d) some of the light of the moon is absorbed by the earth.

5. The sun, the moon, and the stars seem to move across the sky from east to west because
   (a) they send light to the earth.
   (b) they are very far from the earth.
   (c) the earth is turning towards the east.
   (d) the earth is moving around the sun.

B. Directions: Put a check (✓) before each phrase or word which you think will complete the statement correctly. Write the letters of the correct answers on your answer sheet.

1. The earth and other planets
    (a) travel around the sun.
    (b) follow the same path around the sun.
    (c) are of the same distance from the sun.
    (d) are held in their orbits by the sun's gravity.

2. We can tell time by observing
    (a) the position of the sun.
    (b) the size of the moon.
    (c) the corona of the sun.
    (d) the position of certain stars.

3. The sun seems to move in
    (a) an east to west direction.
    (b) a west to east direction.
    (c) a north to south direction.
    (d) all directions.

4. On the surface of the sun are
    (a) sunspots or magnetic storms in the sun.
    (b) mountains and craters.
    (c) planetoids attracted to it.
    (d) thick clouds of poisonous gas.

5. The earth's only moon
    (a) is about 240,000 miles from the earth.
    (b) is much bigger than the earth.
    (c) has gravity which is only one-sixth of that exerted by the earth at its surface.
    (d) has mountains, craters, and valleys of rocks.

C. Directions: Read carefully the situation pictured in Box 1; then read the question raised by Box 2. Check the best answer in Box 3.

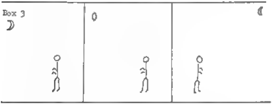
1.

Box 1 	On a clear night you watched the sky and could not see the moon at all because it was a new moon

Box 2

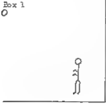
Two or three days after you looked at the moon and saw which of these?

Box 3



2.

Box 1

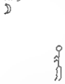


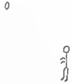
The moon continued each night to show you more and more of its lighted part until you see the full moon.

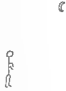
Box 2

About a week after you saw the full moon you saw which of these given below?

Box 3







IV. Knowledge of theories and structures

A. Directions. The pictures on this page give you an idea of the relative size of the nine planets in the solar system.

1. Can you identify them? Write the name of the planet under each picture.
2. If you will show their relative position to the sun, where will the sun be? Show the position of the sun.

(1)

(2)

(3)

(4)

(5)

(6)

(7)

(8)

(9)

B. Directions: Which of these statements:

1. about the solar system are true? Which are false? Write your answer on your answer sheet.
   - (a) The solar system is in the Milky Way galaxy.
   - (b) It is moving all the time at a very high speed.
   - (c) The members of the solar system move at the same speed.
   - (d) The solar system is only part of the universe.
   - (e) The planets are of equal distances from the sun.
   - (f) The sun is near the middle of the solar system.

2. about the planets are true? Which are false? Write your answer on your answer sheet.
   - (a) They rotate on an axis.
   - (b) They all revolve in the same direction around the sun.
   - (c) They get their light and heat from the sun.
   - (d) They revolve around the sun in their own orbits.
   - (e) They are larger than most stars.
   - (f) They can be seen because they reflect light from the sun.
   - (g) They are all the same size and the same distance from the sun.

3. about the earth are true? Which are false? Write your answer on your answer sheet.
   - (a) The earth rotates toward the east.
   - (b) The earth gets its light and heat from the sun.
   - (c) Gravity pulls all objects on the surface of the earth toward the center of the earth.
   - (d) It takes the earth 365 1/4 days to make one rotation on its axis.
   - (e) The earth is much smaller than the moon.
   - (f) The earth rotates much faster than the moon.
   - (g) It takes the earth a year to revolve completely around the sun.

V. Testing for abilities to think critically and solve problems scientifically.

A. Interpretation, making inferences, or extrapolation

Directions: Read the selection carefully, then answer the questions after it. Write only the letters indicating your answer.

Halley's Comet

Halley's comet was named for Edmund Halley, a British astronomer. It was Halley who predicted when the comet would come near enough Earth to be visible on its long trip around the sun. In 1682, Halley predicted that the comet would be next seen in 1758, and it was. Since then it has appeared every 75 or 76 years.

Halley's work on the orbits of comets did much to help people living in his time to know comets were nothing to be afraid of. The fact that their coming and going could be predicted was an important discovery. It lessened people's fear of comets.

After the number on the answer sheet corresponding to that of each statement, write:
A if the information given in the selection is sufficient for you to think that the statement is definitely true
B if the information given in the selection is sufficient for you to think that the statement is probably true
C if the information given in the selection is not sufficient to indicate any of truth or falsity in the statement
D if the information given in the selection is sufficient for you to think that the statement is probably false
E if the information given in the selection is sufficient for you to think that the statement is definitely false

____1. The people before Halley's time have never seen a comet.
____2. Like other planets, Halley's comet moved around the sun.
____3. Seventy-six years after 1682, Halley's comet was seen from earth again.
____4. Halley's comet was last seen in 1910 and will next become visible about 1935.
____5. Halley's discovery made the people more afraid of comets.
____6. Halley never saw the comet after 1682.

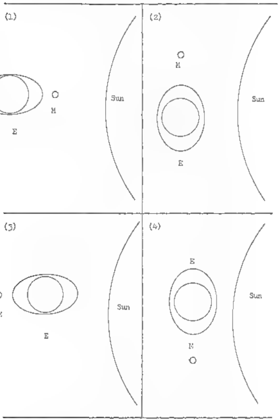
B. Understanding cause and effect relationship
Directions. Below are listed pairs of events. In the blank space between the two events, write:
A - if the first event is the cause or contributing cause of the second event
B - if the first event is the effect or result of the second event
C - if there is no cause and effect relationship

1. It is colder on Mars than it is on earth.	____	Mars is farther from the sun than the earth.
2. Jupiter takes nearly twelve years to revolve in its orbit around the sun.	____	A year on Jupiter is almost as long as twelve years on the earth.
3. A solar eclipse occurred during the year.	____	There was draught and the harvest was poor.

4.	There are low tides on earth.	______	The sun, the moon, and the earth are in one line.
5.	Saturn rotates on its axis once in ten hours and fourteen minutes.	______	A day on Saturn is longer than a day on earth.
6.	Neptune gets less heat and light from the sun than Mars.	______	Neptune is farther from the sun than Mars.
7.	Some form of catastrophe is coming.	______	A comet appears in the sky.
8.	The speed in miles per second of Mercury around the sun is greater than that of Jupiter.	______	Jupiter will complete one revolution around the sun in a longer time.
9.	Most stars are so much farther from us than the sun.	______	The sun is a star.
10.	Mercury has a diameter less than one-half that of the earth.	______	The gravitational attraction of the earth is about twice as much as that of Mercury.

C. Analysis and interpretation

1. Directions: You have learned the causes of tides. Now study the diagrams given below, then answer the following questions as briefly as you can (77).

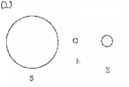

(1)
O
M
E
Sun
(2)
O
M
E
Sun
(3)
O
M
E
Sun
(4)
E
M
O
Sun

(a) Which pictures illustrate the time when the earth has unusually high tides? During what phases of the moon are these? Describe the position of the earth, the moon, and the sun. Explain in one sentence why the tides are unusually high.

(b) Which pictures illustrate the time when the high tides are unusually low? During what phases of the moon are these? Describe the position of the earth, the moon, and the sun. Explain in one sentence why the tides are low.

2. Directions: Which show the conditions necessary for an eclipse of the moon? Write the number of the picture on your answer sheet.

(1)



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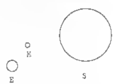

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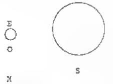
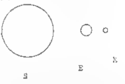


(4)



D. Application

The gravity on Jupiter is enormous because it is the largest and heaviest planet in the solar system. If you were on this planet, every part of you will seem terribly heavy. If you weigh 100 pounds on the earth, you will feel almost three times as heavy on Jupiter. But your muscles are no stronger so you can barely drag yourself across the ground.

Directions: Based on what you have read above, answer the following questions as briefly as you can.

1. Where will you be able to jump higher, on Earth or on Jupiter?
2. Will a load on the shoulder of a man on Earth be heavier or lighter when he moves to Jupiter?
3. Which of the following will explain your answer to question 2?
   (a) The pull of gravity on Jupiter is greater than the pull of gravity on Earth, so things on Jupiter will be heavier.
   (b) The pull of gravity on Jupiter is less than the pull of gravity on Earth, so things on Jupiter will be lighter.
4. Which of the following generalizations will support your answer to question 3?
   (a) The heavier a body is, the greater its pull of gravity.
   (b) The heavier a body is, the less its pull of gravity.

E. Evaluation

Directions. Read the following selection carefully, then answer the question given below it.

Many astronomers have shown great interest in Mars. They have studied its surface features through a telescope and have taken photographs of all its sides. They believe that the reddish color of Mars may be the result of great dust storms blowing across dry, red deserts that might be found on the surface of Mars.

Parts of the surface areas of Mars change color. Sometimes they are green. At other times they are brownish. This has led some scientists to think that Mars may have some kind of seasonal change. Perhaps some form of small plant life exists on this planet. White caps that appear at different times over the north and south poles of the planet add to the thought that Mars may have seasonal changes. The white caps may be thin deposits of ice and snow. This may be the only water on Mars.

1. Do you think life, such as that on Earth, could exist on Mars? Give your reasons.

Essay Tests

1. Discussion
   Discuss how gravity may be an advantage and a disadvantage.

2. Evaluative recall
   Putting all you know about planets together, do you think it will be possible for people to live on any of them? Give your reasons.

3. Application
   What erroneous beliefs about eclipses, comets, meteors, and other heavenly bodies do you know? Explain why they are not true.

4. Explanation
   There are expressions which have been accepted and are commonly used now that are not consistent with what you have learned about the solar system and the universe. For instance, we say that the sun rises in the east and sets in the west, that the moon follows us when we travel at night and that the sun did not shine on a certain day. We talk also of shooting stars. Are these expressions scientifically correct? Explain why they and some others that you know are not consistent with the knowledge you have acquired.

APPENDIX D

EVALUATIVE DEVICES

EXPERIENCE AREA 4 - WAYS AND MEANS
(Practical, Mechanical, Electrical)

Unit V - Common Machanical and Electical Devices Used in the Home and Industry: Heat and Light

Experience Area 4 - Common Mechanical and Electrical Devices Used in the Home and in Industry: Heat and Light

Objective Tests

I. Knowledge of terminology

Directions: From the list in Column I, select the word or phrase which most nearly corresponds in meaning to the descriptions given under Column II. Write only the letter of your answers on the blanks.

A.

Column I	Column II
a. conductor	___1. the complete path along which an electric current flows
b. insulator	___2. the flow of electricity along a wire
c. current	___3. any material through which current will flow easily
d. circuit	___4. the part of an electric circuit that melts and breaks the connection when the current becomes dangerously strong
e. switch	___5. a material through which electric current does not readily flow
f. fuse	

B.

Column I	Column II
a. generator	___1. the amount of current flowing in a conductor in one second
b. volt	___2. an electron in the outer shell of an atom
c. ampere	___3. a machine that changes mechanical energy into electrical energy
d. bound electron	___4. a device that changes electric current into one of higher or lower voltage
e. transformer	
f. free electron	___5. a unit used to measure the force pushing the electrons through a conductor

II. Knowledge of specific facts, conventions, trends and sequences, classification and categories, criteria, methodology, theories and structure

A. Directions: Read each question carefully. For each question there are four possible answers. Write on your answer sheet the letter of the best answer to the statement

1. Atoms differ from one another with regard to the number of protons and
   (a) electrons, (b) nucleus, (c) static charges, (d) positive charges they contain.

2. When an electron is lost, the atom
   (a) becomes neutral, (b) loses its power of attraction, (c) has a negative electrical charge, (d) has a positive electrical charge.

3. When an atom loses an electron, the atom becomes
   (a) balanced, (b) unbalanced, (c) negatively charged, (d) magnetized.

4. The parts of the atom that move freely around its nucleus are the
   (a) electrons, (b) neutrons, (c) protons, (d) shells.

5. Lightning is a form of
   (a) atomic energy, (b) current electricity, (c) electric shock, (d) static electricity.

6. An example of a good conductor of electricity is
   (a) copper, (b) iron, (c) nichrome, (d) tungsten.

7. Rubber will make a good
   (a) conductor, (b) insulator, (c) filament, (d) electrode.

8. Scientists found that the use of finer wires will
   (a) decrease, (b) increase, (c) will not change, (d) eliminate the resistance of the wire to the flow of electrons.

9. Each electron
   (a) is neutral, (b) has a negative electric charge, (c) has a positive electric charge, (d) has no electrical charge.

10. The nucleus of an atom exerts a strong force of attraction on the
    (a) bound electrons, (b) free electrons, (c) protons of other atoms, (d) neutrons of other atoms.

11. A material that gains electrons becomes
    (a) negatively charged, (b) positively charged, (c) neutral, (d) balanced.

12. A positively charged material will repel
    (a) any kind of material, (b) negatively charged materials, (c) positively charged materials, (d) no material.

13. An instrument for detecting and measuring a small current is called
    (a) a commutator, (b) an electric meter, (c) a galvanometer, (d) a thermocouple.

14. The filaments in electric light bulbs are most often made of
    (a) copper, (b) iron, (c) silver, (d) tungsten.

15. Electric current is the movement of
    (a) atoms, (b) electrons, (c) neutrons, (d) protons.

16. Electricity consumed during the month is measured by
    (a) the watt-hour, (b) kilowatt-hour, (c) the voltage, (d) the ohm.

17. Increasing the voltage will
    (a) decrease, (b) increase, (c) make no difference in,
    (d) prevent the flow of electrons in a wire.

18. If we connect two or more cells we make
    (a) a battery, (b) an electromagnet, (c) an electric motor, (d) a switch.

19. A material that prevents the passage of electricity or heat is
    (a) a conductor, (b) a dry cell, (c) an insulator, (d) a fuse.

20. A device that changes electric energy into mechanical energy is
    (a) a generator, (b) a motor, (c) a storage cell, (d) a thermocouple.

21. Magnetic poles are called
    (a) negative and positive, (b) north and south, (c) plus and minus, (d) electron and proton.

22. Each electron is
    (a) a negative electrical charge, (b) a minus electrical charge, (c) a positive electrical charge, (d) an N electrical charge.

23. We pay for electricity we have consumed during the month by the
    (a) watt-hour, (b) ampere per second, (c) kilowatt-hour, (d) voltage.

24. The unit of electrical resistance is the
    (a) ampere, (b) ohm, (c) volt, (d) watt.

25. Lamps may be connected either
    (a) crosswise or lengthwise, (b) positively or negatively, (c) in series or parallel, (d) from north pole or south pole.

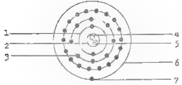
B. Directions. From the list of forms of energy given under Column I select the answer which will match each item in Column II. Write only the letter of the correct answer.

Column I	Column II
a. chemical energy	____1. thermocouple
b. mechanical energy	____2. solar battery
c. light energy	____3. wet cell
d. heat energy	____4. generator
	____5. photoelectric cell
	____6. storage battery
	____7. piezoelectric
	____8. dry cell

C. Directions: Below are the names of some scientists and their valuable contributions to modern civilization. Match the items under Column I with those given under Column II. Write only the letters of the correct answers on your answer sheet.

Column I	Column II
a. Hans Christian Orsted	____1. Invented the wet cell for producing electricity.
b. Thomas Edison	____2. Invented the telegraph.
c. Michael Faraday	____3. Discovered that electric current flowing through a wire produced electricity.
d. Alessandro Volta	
e. Benjamin Franklin	____4. Invented the first electric light bulb.
f. Samuel Morse	____5. Invented the first generator.

D. Knowledge of structure
Directions. Many scientists think that the structure of an atom of copper is like this. Indicate the parts of an atom by putting the corresponding numbers indicated in the illustration before each of the items given under it. Write the numbers on the blanks before the items. Number one is done for you.



_1_ a. inner shell
____ b. bound electron
____ c. protons
____ d. nucleus
____ e. outer shell
____ f. free electron
____ g. neutrons

E. Knowledge of basic science concepts, generalizations, and principles

Directions Put a check (✓) before each phrase or word which you think will complete the statement correctly.

1. Electrons may be removed from the atoms in a material by
   (a) rubbing or friction
   (b) heating
   (c) magnetism
   (d) freezing
   (e) pressure

2. The fuse of an electric circuit melts. Which of the following may be a possible cause?
   (a) the switch was turned off
   (b) there was a short circuit
   (c) a transformer was used
   (d) the current was overloaded
   (e) parallel circuits were used

3. The strength of an electric current depends on
   (a) the speed of the movement of the electrons
   (b) the number of moving protons
   (c) the number of moving electrons
   (d) the speed of the moving neutrons
   (e) the size of the atoms

4. Electric current may be controlled by
   (a) fuses
   (b) insulating materials
   (c) electromagnets
   (d) switches
   (e) transformers

5. All house circuits are wired in parallel so that
   (a) the lights and other appliances can be used separately without breaking the circuit
   (b) the circuit will not be overloaded
   (c) less switches will be needed
   (d) if one lamp fails to function, the other lights and appliances can continue to function
   (e) less wires will be used

6. Electrical energy can also be changed to light energy by passing an electric current through
   (a) mercury gas
   (b) neon gas
   (c) silicon gas
   (d) sodium gas
   (e) chlorine gas

F. Knowledge of classification
Directions: Classify the following items under the proper heading.

1. electric stove
2. fluorescent lamp
3. electric mixer
4. door bell
5. electric bulb
6. electric toaster
7. electric fan
8. flashlight
9. electric iron
10. washing machine

Electric Appliances and Devices that Produce

Heat	Light	Motion

G. Knowledge of methodology
1. Show how you will wire one dry cell and two lamps in series.
2. Show how you will wire a circuit using one dry cell and two lamps across parallel wires.

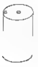
III. Testing for abilities to think critically and solve problems scientifically

A. Translation

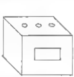
Directions: Which of the following is:

(1) an example of a primary cell?
(2) an example of a secondary cell?

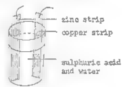
Write the letter of your answers on your Answer Sheet.



A. Dry cell



B. Storage battery



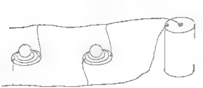
C. Voltaic or wet cell

B. 1. Analysis

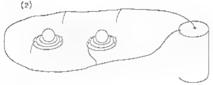
Directions: Look at the illustrations carefully. Then answer the questions below by writing on your answer sheet the number of the correct answers (28).

(a) Which are illustrations of
(1) closed circuits? (2) open circuits? (3) parallel circuits? (4) series circuits? (5) short circuits?
(b) In which circuits will the lamps light?
(c) In which circuit will there be no light? Give your reason.

(1)



(2)



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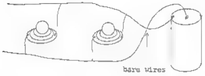

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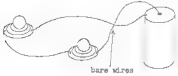

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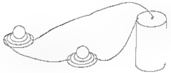
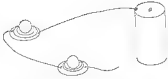
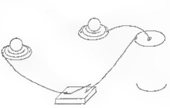


(6)



2. Directions. Study the illustration below and answer the questions under it.



What is wrong?

(a) Why will the lamps not be lighted?
(b) Complete the drawing and trace the path of the current by drawing arrows.
(c) The lamps are connected in what kind of circuit?

C. Determining if a statement can be verified scientifically
Directions: For each of the statements listed below, write:

- A if the statement can be scientifically verified
- B if the statement is an accepted theory and hence need not be scientifically verified
- C if the statement contains a value judgment and hence cannot be scientifically verified
- D if the statement is a definition and needs no further verification

1. All matter is made up of atoms.
2. When two positively charged materials are brought together, they repel each other.
3. Many people prefer to use fluorescent lamps rather than electric light bulbs.
4. The wire that gives off light in an electric light bulb is a filament.
5. An electric current will flow only through a closed circuit.

D. Application of principles and generalizations

Directions: Read the following paragraphs, then answer the questions given after them. Write only the letters of your answers on your answer sheet.

1. Arturo got a slight shock by walking across a thick woolen rug and then turning a metal door knob.
    (a) What was the cause of the shock?
        (1) electric current in the door knob
        (2) electric current in the woolen rug
        (3) static electricity
        (4) magnetic force of the door knob

    (b) On what kind of day did this probably happen?
        (1) on a rainy day
        (2) on a dry day
        (3) on a hot humid day
        (4) during a thunderstorm

    (c) Choose the reason you would use to explain or support your answer for (b).
        (1) Rain is a good conductor of electricity.
        (2) Moisture in the air carries away the charge as rapidly as it is made.
        (3) On a hot day, heat energy is changed to electrical energy.
        (4) There is much electricity in the air during a thunderstorm.

E. A group of children were experimenting with an electromagnet. They got an iron nail and wound ten turns of insulated copper wire around it. They connected the ends of the wire to a dry cell and held the electromagnet over some tacks. The electromagnet picked up a few tacks. How can they make the electromagnet attract more tacks?

(a) By winding more turns of wire around the nail.
(b) By winding fewer turns of wire around the nail.
(c) By using a longer nail.
(d) By increasing the number of cells used.

E. Ability to solve problems scientifically

1. About 67 years ago Thomas Edison began to wonder whether there was not some way to make a better electric lamp. 2. First he tried to find a material that would give a bright light when it was heated. 3. Such a material was very hard to find. 4. It had to carry electric current and had to get very, very hot without melting or burning.

5. After trying hundreds of different materials he made a thread of carbon that did what he wanted it to do. 6. It carried electric current and got very hot without melting. 7. To keep it from burning, he put it inside a glass bulb. 8. Then he pumped out most of the air.

9. But the carbon thread did not work well. 10. The hot carbon gave off light but the heat soon made the carbon fall to pieces. 11. So scientists went to work to find a better material to use. 12. They wanted a material that would last longer and give more heat.

1. Ability to recognize a problem
   Which of the sentences in the paragraph constitute a problem? Write the number of the sentence.
2. Ability to recognize hypotheses used in solving a problem
   Which sentences tell what Edison did to solve his problem?
3. Ability to evaluate data, conclusions, and implications
   Choose the conclusion which you think is most consistent with the fact given above and most reasonable in the light of whatever knowledge you may have. Write the letter indicating your answer.
   (a) Thomas Edison was unsuccessful in his experiment.
   (b) Thomas Edison did not find the materials he needed to do his experiment.
   (c) Thomas Edison was successful in his experiment.
   (d) Scientists helped Thomas Edison in his experiment.

   Choose the reason you would use to explain or support your conclusion by writing the letter of the correct answer.
   (a) The heat caused the carbon to fall into pieces.
   (b) The material needed was very hard to find.
   (c) The thread of carbon carried electric current; got very hot without melting.
   (d) Scientists helped Edison to find the material he needed.

F. Ability to interpret data and make inferences

Directions: On your answer sheet write.

A if the information given in the paragraph under E is sufficient for you to think that the statement is definitely true

B if the information given in the paragraph is sufficient only to indicate that the statement is probably true

C if the information given in the paragraph is not sufficient to indicate any truth or falsity in the statement

D if the information given in the paragraph is sufficient for you to think that the statement is probably false

E if the information given in the paragraph is sufficient for you to think that the statement is definitely false

1. Edison used a glass bulb to give the carbon threads a continuous supply of air.
2. Scientists continued the work of Edison.
3. If the carbon did not get very hot it would not give off light.
4. It did not take long for scientists to find a better material than carbon.
5. Edison did not want the carbon thread to get very hot.

C. Cause and effect relationships

Directions: Each item given below states a cause and effect relationship which you are to accept or reject. On the blank before each item, write A if you accept the statement; B if you reject it.

____1. There is a break in the circuit. // Electric current flows part of the way until it reaches the break in the circuit.

2. The fuse in an electric circuit melts. // The light goes out.

____3. Current flows through the electromagnets of an electric bell. // The hammer strikes the gong.

____4. The N pole of the armature comes in contact with the N pole of the field magnet. // The armature is attracted by the field magnet.

____5. Ultra violet rays strike the fluorescent chemicals in the glass tube. // Light is produced.

6. The two ends of a piece of copper wire were connected to a dry cell. // Electrical energy was changed to chemical energy.

____7. Electric current stops flowing through an electromagnet. // The electromagnet pulls some pins to it.

____8. Electrical energy flows through a piece of silver wire. // Much of the electrical energy is changed to heat.

____9. The circuit was overloaded. // The fuse melts.

___10. The air was rapidly heated from an electric discharge from the clouds. // Thunder is produced.

H. Evaluation

Directions: Put a cross (x) after each statement which tells something children should not do.
Put a check (✓) after each statement which tells something all children should do (9).

1. Play with any electric wires you may see.
2. Report the matter to the electric company if your lights are not working well.
3. Report to the electric company any exposed wires in your home.
4. Examine any electrical device you may see so that you will learn about electricity.
5. Put away all dangling wires you may see in the street.
6. Fly your kites in places where there are electric wires.
7. Keep your hands away from electric sockets.
8. Ask the advice of any electrician if there is anything wrong with your electric light, before trying to do anything about it.
9. Read under an electric lamp if you have one because it gives excellent light.
10. Dry your clothes with an electric lamp. It is a good heater.

I. 1. Plan an experiment which can be used to show that like electrical charges repel each other and unlike electrical charges attract each other.

2. Plan an experiment which can be used to determine which of the two poles of two magnets are the north pole.

Essay Tests

1. Comparison
Discuss how a dry cell and a wet cell are alike and how they are different.

2. Explanation
Explain how electricity has improved our modern life.

3. Discussion
Discuss the contributions that some scientists have made to the field of electricity.

4. Selective recall
Write a composition on some safety precautions that must be taken in connection with the use of electricity.

5. Illustration or examples of principles
Explain how some household appliances and devices make use of electricity.

APPENDIX E

EVALUATIVE DEVICES

EXPERIENCE AREA 5 - THE HUMAN BODY AND ITS CARE

Unit VII - Safety First: First Aid

Unit VIII - The Right Kinds of Food: Their Selection and Preparation

Unit IX - Body Structure and Growth

Unit X - Communicable Diseases and Other Illnesses Affecting the Different Organs of the Body

Experience Area 5 - The Human Body and Its Care

Objective Tests

I. Knowledge of terminology

Directions: In the items below, select the word or phrase that will best help explain the meaning of the underlined word. Write its letter on your answer sheet.

1. A carrier is a person who (a) is sick with the disease, (b) has symptoms of the disease, (c) may transmit a disease and not be ill with the disease, (d) has just had the disease.

2. A communicable disease is a disease that (a) can be transmitted from one person to another, (b) is not transferrable from one person to another, (c) is caused by improper diet, (d) can be controlled through vaccination.

3. To contaminate means (a) to visit a sick person, (b) to soil any article with germs, (c) to kill the germs causing the disease, (d) to talk to a person who has the disease.

4. There is an epidemic when (a) many people die, (b) the hospitals are overcrowded with patients, (c) people die of cholera, (d) many people are sick of the same disease at the same time.

5. A person is said to be immune to a certain disease when (a) he is likely to get the disease easily, (b) he shows a greater resistance to infection than others, (c) he has had the disease, (d) he is completely safe from getting the disease.

6. Malnutrition is a condition that results in the human body due to (a) excess food, (b) infectious diseases, (c) lack of the right kind of food, (d) weak heart.

7. Germ is a word commonly used to mean (a) all kinds of bacteria, (b) any disease producing organism, (c) any kind of illness, (d) dust and other dirt.

8. An electro-cardiograph is an instrument that records (a) blood pressure, (b) heart beat, (c) pulse rate, (d) rate of respiration.

9. The pulse is the (a) beating of the heart, (b) expansion and contraction of an artery, (c) flowing of the blood in the veins, (d) sound made by the blood at the wrist.

10. A muscle contracts when (a) it becomes longer, (b) it becomes narrower, (c) it becomes shorter, (d) it becomes softer.

11. To circulate means (a) to move around, (b) to arrange in groups, (c) to draw a circle, (d) to join one end to the other.

12. A capillary is a small blood vessel that (a) carries blood from the heart, (b) carries blood to the heart, (c) connects the tiniest of the arteries and veins, (d) carries the red and white cells of the blood.

13. The skull is the bony framework of (a) the spinal cord, (b) the limbs, (c) the chest cavity, (d) the head.

14. Perspiration is the liquid containing waste materials that (a) passes out of the lungs, (b) passes out to the surface of the skin, (c) passes out through the bladder, (d) passes out through the large intestine.

15. Caffeine is a stimulant found in (a) candies, (b) coffee and tea, (c) tobacco, (d) foul air.

II. Knowledge of specific facts, conventions, trends and sequences, classification and categories, criteria, and methodology

A. Directions. Read each question carefully. For each question there are four possible answers. Write on your answer sheet the letter of the best answer to the statement.

1. About two-thirds of the body weight is made up of (a) bones, (b) muscles, (c) nerves, (d) water.

2. Egg is rich in (a) iodine, (b) protein, (c) starch, (d) sugar.

3. A person who has a severe lack of vitamin A may suffer from (a) excessive bleeding, (b) night blindness, (c) pellagra, (d) scurvy.

4. The process of breaking down foods and changing them into liquid is called (a) circulation, (b) excretion, (c) respiration, (d) digestion.

5. A group of organs working together is called (a) a system, (b) a framework, (c) a tissue, (d) a combination.

6. The process in which living things use the oxygen they take into their bodies is called (a) digestion, (b) reproduction, (c) respiration, (d) excretion.

7. Drinking water is often treated with (a) chlorine, (b) hydrogen, (c) nitrogen, (d) phosphorus.

8. A very important mineral needed by the body is (a) calcium, (b) magnesium, (c) sulphur, (d) zinc.

9. The scientist who is credited with the discovery of vitamins is (a) Fleming, (b) Salk, (c) Pasteur, (d) Funk.

10. One effective way of preventing tooth decay is treating drinking water with (a) iodine, (b) iron, (c) magnesium, (d) sodium fluoride.

11. Water helps in regulating body temperature through (a) the blood plasma, (b) the muscle cells, (c) perspiration, (d) part of the brain.

12. The classes of substances in the food eaten by man are called (a) calories, (b) fuel, (c) nutrients, (d) toxin

13. The amount of energy a food produces when it is digested is measured in units called (a) calories, (b) heat, (c) nutrients, (d) food substances.

14. Bones are held together by (a) joints, (b) ligaments, (c) capillaries, (d) nerve tissues.

15. Muscles that we can control or move at will are called (a) involuntary muscles, (b) muscle tissues, (c) flexible muscles, (d) voluntary muscles.

16. A muscle works by (a) contracting, (b) expanding, (c) hardening, (d) twisting.

17. Digested food materials pass into the blood through the walls of the (a) kidneys, (b) large intestine, (c) small intestine, (d) stomach.

18. Food materials that were not digested go to the (a) kidneys, (b) large intestine, (c) small intestine, (d) stomach.

19. The cells get food materials carried by the blood through the (a) capillaries, (b) veins, (c) heart, (d) nerves.

20. Hormones are chemicals given off by the (a) blood, (b) lungs, (c) glands, (d) heart which regulate body activities.

21. The sensations of pressure and pain are located in the (a) eyes, (b) nose, (c) skin, (d) tongue.

22. Taste buds at the back of the tongue are sensitive to (a) sweet, (b) sour, (c) bitter, (d) salty flavors.

23. An ophthalmologist is a doctor who works with the (a) ears, (b) eyes, (c) heart, (d) lungs.

24. You can count a person's pulse beats in one minute by (a) placing your thumb on his wrist below the base of his thumb, (b) placing your first two fingers on his wrist below the base of his little finger, (c) placing your thumb on his wrist below the base of his little finger, (d) placing your first two fingers on his wrist below the base of his thumb.

25. The best way of cooking vegetables is by (a) covering them tightly and cook them until just tender, (b) cooking them until they are very soft, (c) cooking them long enough without the lid on, (d) remove them from the fire before they are cooked.

26. Depths of burn injuries are classified as (a) first degree, second degree, third degree, (b) minor injury, deep injury, serious injury, (c) red, blister, wound, (d) skin injury, muscular injury, bone injury.

27. Evidence of infection usually appears (a) immediately after the injury, (b) two to seven days or more following the injury, (c) after the wound has healed, (d) only after some pus appears.

28. The growth of harmful germs in a wound constitutes a wound (a) infection, (b) abrasion, (c) incision, (d) laceration.

B. Directions. Put a check (✓) before each phrase or word which you think will complete the statement correctly.

1. Which of the following
   (a) are fuel foods to the body?
      (1) protein
      (2) fats
      (3) minerals
      (4) sugar
      (5) starch

   (b) helps in the clotting of the blood?
      (1) vitamin C
      (2) iron
      (3) calcium
      (4) vitamin A
      (5) vitamin K

   (c) are vitamin B?
      (1) thiamine
      (2) niacine
      (3) riboflavin
      (4) ascorbic acid
      (5) menodine

   (d) rich in protein?
      (1) rice
      (2) milk
      (3) beans
      (4) eggs
      (5) meat

(e) diseases have been controlled in the Philippines by vaccinating young children?
- (1) chicken pox
- (2) cholera
- (3) mumps
- (4) smallpox
- (5) measles

(f) are examples of an involuntary muscle?
- (1) heart muscle
- (2) muscles of the legs
- (3) muscles that operate the eyelid
- (4) back muscles
- (5) muscles of the stomach

(g) are examples of endocrine or ductless glands?
- (1) sweat glands
- (2) thyroid glands
- (3) pituitary glands
- (4) adrenal glands
- (5) liver

(h) characterize _first aid_ treatment?
- (1) it is given only after the physician has arrived.
- (2) it is given promptly after the accident or illness has occurred.
- (3) it can take the place of the services of the physician.
- (4) it stops as soon as the physician arrives.
- (5) it is permanent in nature.

(i) are parts of first aid treatment?
- (1) treating or easing the injured part.
- (2) giving the person words of encouragement.
- (3) investigating who caused the injury.
- (4) calling for medical help or an ambulance.
- (5) notifying a relative.

(j) should a first aider not do?
- (1) give first aid to major as well as minor injuries.
- (2) give water to a partly conscious or unconscious person.
- (3) make all efforts to rouse an unconscious person by talking to him or shaking him gently.
- (4) lift an unconscious person by the belt to increase his supply of oxygen.
- (5) diagnose, evaluate, and predict what may possibly happen and answer all questions asked.

2. The cells of the human body
   - (a) differ in size
   - (b) are of the same shape
   - (c) do the same kind of work
   - (d) need food and oxygen
   - (e) produce waste materials

3. The important systems in the body include the
   - (a) abdomen
   - (b) excretory
   - (c) trunk
   - (d) respiratory
   - (e) endocrine

4. Examples of tissues found in the body are
   - (a) muscle tissue
   - (b) blood tissue
   - (c) brain tissue
   - (d) skin tissue
   - (e) hair tissue

5. Saliva helps in the digestion of food by
   - (a) moistening and softening the food
   - (b) changing sugar into starch
   - (c) changing starch into fat
   - (d) changing starch into sugar
   - (e) changing fat into sugar

6. The blood is the transportation system of the body because
   - (a) it carries digested food from the intestines to the body cells
   - (b) it carries undigested food from the small intestine to the large intestine
   - (c) it carries oxygen from the lungs to the body cells
   - (d) it carries messages from the sense organs to the brain
   - (e) it carries carbon dioxide from the cells to the lungs

7. The hemoglobin in the red cells of the blood
   - (a) gives the blood a red color
   - (b) carries oxygen to the cells
   - (c) carries carbon dioxide to the lungs
   - (d) destroy bacteria and other disease germs
   - (e) carries the white cells

8. The cerebrum which is the largest part of the brain
   - (a) controls thinking, reasoning, learning, memory, and imagination
   - (b) helps the body keep its sense of balance
   - (c) receives messages from the sense organs
   - (d) controls the voluntary movements of the body
   - (e) controls digestion, breathing, and the circulation of the blood.

9. Typhoid fever may be controlled and prevented by
   - (a) protecting and treating the water supply
   - (b) covering all standing water
   - (c) sanitary disposal of human waste
   - (d) inoculation or immunization
   - (e) sleeping under a mosquito net

10. Sources of infection for ringworms may include
    - (a) barber or beautician's clippers
    - (b) pillow cases and towels
    - (c) water
    - (d) food
    - (e) backs of theater seats

11. Cholera is a dreadful disease characterized by
    - (a) vomiting and severe dehydration
    - (b) high fever, chills, and profuse sweating
    - (c) "rice water" stools
    - (d) severe coughing
    - (e) skin rashes

12. A good first aidar
    - (a) confines himself only to the injury
    - (b) knows what to do
    - (c) knows what not to do
    - (d) does only what is necessary
    - (e) handles the injured part to the minimum

C. Directions: Match the words in the right-hand column with the phrases at the left. Write in each blank the number of the right word or words which match with the phrase.

1. Column I

___(a) Digests food for the body.
___(b) Carries food and oxygen to the different parts of the body.
___(c) Takes in oxygen and gets rid of carbon dioxide.
___(d) Controls body actions.
___(e) Enables the body to move.
___(f) Supports and gives the body its shape.
___(g) Contains the brain.
___(h) Contains the heart, windpipe, and lungs.
___(i) Arms and legs.
___(j) Contains the stomach, intestines, liver, pancreas, kidneys, bladder, and other organs.
___(k) Covers the body

Column II

1. Nervous system
2. Head
3. Muscular system
4. Limbs
5. Digestive system
6. Abdomen
7. Respiratory system
8. Skin
9. Circulatory system
10. Excretory system
11. Skeletal system
12. Chest

2. Column I

Signs and Symptoms

___(a) Itching of the skin produced by mites.
___(b) Irritation and redness of the eyes.

Column II

Diseases

1. Influenza
2. Malaria

___(c) Raised pimples filled with clear fluid.
___(d) Fever with chills, exhaustion and pains in the back, legs, and shoulders.
___(e) Painful swelling in front of the ear and jaw.
___(f) Watery stools containing blood and mucus.
___(g) Afternoon fever, coughing, and loss of weight.
___(h) Enlargement of the spleen, fever with chills, and sweating.

3. Whooping cough
4. Dysentery
5. Chicken pox
6. Mumps
7. Conjunctivitis
8. Measles
9. Tuberculosis
10. Scabies

3. Column I

___(a) Prevents anemia.
___(b) Increases appetite.
___(c) Transport dissolved foods and wastes.
___(d) Needed by the thyroid glands.
___(e) Prevents scurvy.
___(f) Repairs and builds tissues.
___(g) Prevents rickets.
___(h) Supply energy.

Column II

1. Iodine
2. Vitamin B_2
3. Vitamin C
4. Vitamin D
5. Iron
6. Carbohydrates
7. Calcium
8. Vitamin B_1
9. Protein
10. Water

4. Column I

___(a) Nearby objects can be seen clearly.
___(b) Beriberi.
___(c) Lines running in some directions are blurred.
___(d) Toxin
___(e) Vaccination.
___(f) Nearby objects are blurred; distant objects are clear.
___(g) Inability to recognize color.

Column II

1. Farsightedness
2. Color blindness
3. Immunity
4. Nearsightedness
5. Vitamin B_1
6. Poison
7. Germ killer
8. Vitamin B_2
9. Astigmatism

5.

Column I	Column II
____(a) Guava tree.	1. Ringworm
____(b) Cinchona tree.	2. Asthma
____(c) Duhat tree.	3. Tuberculosis
____(d) Eucalyptus tree.	4. Kidney trouble
____(e) Ebony tree.	5. Typhoid fever
____(f) Dalampunay plant.	6. Malaria
	7. Common colds
	8. Antiseptic

D. Knowledge of sequences

Directions: The sense of hearing is located in the ear. Indicate the path of the sound waves from the outer ear to the brain by numbering the following items in the proper order.

____1. Sound waves strike the eardrum causing it to vibrate.
____2. Massages or nerve impulses are sent to the auditory nerves.
____3. Sound waves are collected and sent through a tube.
____4. The membrane of the inner ear vibrates.
____5. Nerve impulses are sent to the brain.
____6. Hammer, anvil, and stirrup vibrate.
____7. Nerve endings receive the vibrations.

E. Knowledge of classification

1. Directions. Complete the chart given below by writing in the proper columns the names of the foods given under the chart. A name may appear in two or more columns.

Vitamins	Proteins	Carbohydrates	Fats	Minerals

meat
eggs
coconut milk
cream
corn
mangoes
papayas
salt
chicken
cheese
cabbage
potatoes
gabi
butter
ampalaya
peas
lard
beans
liver
carrots
ubi
rice
kangkong
avocadoes
milk
mongos
lemon juice
orange
tomatoes
pechay
nuts
lettuce

2. Directions: Write in the proper column the letter indicating the method or ways by which the disease under each heading may be prevented.

Hookworm	Tapeworm, Ascaris, Trichina	Rickets	Goiter	Food Poisoning	Tetanus	Heart Attack

Ways of Control or Prevention

(a) Eating foods rich in iodine and using iodized salt.
(b) Keeping wounds and burns clean and free from soil contamination.
(c) Avoiding contaminated and half-cooked meat
(d) Prompt refrigeration of foods and adequate cooking or heating of prepared foods.
(e) Preventing soil pollution and always wearing some kind of footwear
(f) Control of weight, avoiding emotional tension and strenuous exertion, and getting adequate rest and sleep.
(g) Eating foods rich in vitamin D and reasonable exposure to sunlight.

3. Directions. Below are the functions of the different glands of the body and some illnesses that people develop when these glands are not working properly. Write the functions and the illnesses under the proper heading in the chart.

Functions

a. Regulates the growth of the body.
b. Controls the speed at which the body burns and uses food.
c. Controls use of calcium in the body.
d. Regulates use and storage of sugar in the body.
e. Clots blood easily and makes the heart beat faster.
f. Breaks protein down into simpler materials.
g. Breaks fat up into simpler materials.
h. Changes starch into sugar.

Illnesses

i. Diabetes
j. Soft bones
k. Stunted growth -- midget
l. Hemorrhage
m. Goiter

Duct and Ductless Glands

Salivary	Gastric	Liver	Pituitary	Thyroid	Para-thyroid	Islands of Langerhans	Adrenal

F. Knowledge of criteria

Directions: If you were asked to go to the market to buy your family some food for lunch, which of the following will you use as criteria for selecting the items you will buy? Check your answers.

1. Nutritious but expensive foods
2. Refrigerated or frozen foods
3. Inexpensive but nutritious food
4. Fresh foods
5. Not nutritious but very attractive foods
6. Sanitarily prepared or packed foods
7. Delicious but not nutritious food
8. Foods that are in season
9. Cheap but smuggled meat and pork
10. Unfamiliar foods

G. Knowledge of methodology

Directions: Most accidents are minor and the first aid needed is obvious to a trained person. However, in case of serious injury, certain procedures are applicable. Read the following sequence of action and number them in the proper order (76).

____1. Have the victim lie down and protect him from disturbance.
____2. Plan what to do.
____3. Give at once the urgently necessary first aid in case of severe bleeding, poisoning, or of stopped breathing.
____4. Check for injuries.
____5. Carry out the indicated first aid.

H. Knowledge of structure

Directions: From the list of answers in Column II select the answer which matches each item of Column I, and write the number of the answer on the blank at the left of the item.

1.

Column I	Column II
___(a) A group of the same kind of cells that carry on the same kind of work.	1. Muscle 2. System
___(b) A group of different tissues all working together.	3. Joints
___(c) Keep the bones from grinding together when they move.	4. Tissue
___(d) Place where parts of the skeleton come together.	5. Ball-and-socket
___(e) Allows the part to move back and forth.	6. Cartilage
___(f) Allows the part to move in many directions.	7. Hinge joint 8. Organ

2.

Column I	Column II
___(a) Pumps blood through the blood vessels.	1. Nostrils
	2. Nerves
___(b) Carries blood to the heart.	3. Heart
___(c) Filters the dust and warms the air we breathe.	4. Lungs
___(d) Carries blood away from the heart to body tissues.	5. Blood
	6. Veins
___(e) Carry messages to and from the various parts of the body.	7. Arteries

3.

Column I	Column II
___(a) Controls the amount of light that enters the eyeball.	1. Eyelids
	2. Lens
___(b) Protects the front of the eye.	3. Retina
___(c) Dark opening of the eye.	4. Iris
___(d) Bends the light rays entering the eyeball.	5. Cornea
___(e) Place where the image is focused.	6. Pupil

III. Testing for abilities to think critically and solve problems scientifically

A. Translation

Directions. Your body is a wonderful living machine made up of different parts that do a special kind of job. Think of how your body works and answer the following questions. Select your answers from the items given after the questions.

____1. Which is the transportation system of the body?
____2. Which part works like a pump?
____3. Which is like a camera?
____4. Which is the main cable of the body?
____5. Which is the director of all its activities?
____6. Which are the soldiers or security guards?

(a) skeletal system
(b) spinal cord
(c) circulatory system
(d) lungs
(e) muscles
(f) white corpuscles
(g) eye
(h) heart
(i) hands
(j) brain

B. Interpretation

A survey of the causes of illnesses among Grade VI children was made in an elementary school. The following results were reported.

Kinds of Illnesses	Percentage of Children Who Were Sick
Common colds	36
Toothache	11
Headache	9
Flu	8
Accidents	14
Measles	3
Chicken pox	3
Intestinal disorder	6
Sore eyes	2
Other causes	8

Directions: Below are some statements that are interpretations of the above data. For each statement, write:
T if the statement is a reasonable interpretation of the above data
U if there is insufficient evidence supporting the statement
F if the above data contradict the statement

1. Reading points
____(a) Most of the children who got sick were injured.
____(b) Eleven percent are not brushing their teeth.

2. Comparison of reading points
____(a) More children had measles than chicken pox.
____(b) Less children had toothaches than other illnesses.

3. Cause
____(a) Most accidents are the results of carelessness.
____(b) Lack of sleep is one cause of headache.

4. Effect
____(a) If children were more careful with the foods they eat, there would be less intestinal disorders.

5. Value judgment
____(a) Children need more lessons on the causes and prevention of common colds.

C. Applying generalizations to certain situations

1. Directions: Write in the blank after each situation the safety rule or generalization which pertains to the situation or which would prevent the occurrence of the accident described (9).

The first one is done for you. Do the rest.

(a) Linda placed her pencil in her notebook with its point protruding from the notebook. As she passed by Anita, the pencil point grazed Anita's arm and caused it to bleed. Anita went to the clinic for treatment.

Carry pointed or sharp-edged objects with the edge pointed downward.

(b) Isabel has a sore eye. Mother asked her to get the boric acid and argyrol from the medicine cabinet so she can treat the sick eye before she leaves for school. Hurriedly, Mother washed the sick eye with boric acid and then applied on it a drop of argyrol. How the medicine hurt Isabel's eyes! Frightfully, Mother looked at the label. It was iodine instead of argyrol!

____

____

(c) Mona wanted to remove a picture frame from the wall. She stepped on a rocking chair nearest to it and tried to reach it. As she stood on the chair it rocked to one side and Mona fell down. She sprained her ankle.

____

____

(d) Ramon and Luis were flying toy airplanes on their way home from school. Ramon's airplane dropped on the middle of the street. He ran after it, unmindful of a coming jeep. The jeep overtook him and he was run over.

____

____

(e) Estela left her toys on the hallway before she went to bed. Early the next morning, Grandmother tripped over them and had a bad fall. She was taken to the hospital because of a broken hip.

____

____

(f) Mrs. Reyes forgot to turn off the electric iron she was using before she went to the kitchen. When she returned part of the ironing board was burning. Fortunately she had a fire extinguisher installed in the room. The fire was put out immediately.

____

____

(g) Pakito leaned against the handrails while he talked to his friend. Suddenly the handrails gave way. Pakito fell and had a fractured arm and leg.

____

____

(h) During an excursion, Jose and Lito sneaked out of the picnic grounds and swam in a nearby sea. The current was swift and the waves carried them far out into the sea. They cried for help but there was no one on the beach. Unfortunately the two boys were drowned.

____

____

(i) Ernesto threw a piece of stone at a dog on the roadside. He missed the dog and the stone struck a child who was playing by the house near the road.

____

____

(j) Nena's little sister saw a match on the table. She had seen her Mother use it every time she wants to start a fire. She played with it and her dress caught fire.

____

____

2. Directions: Under each problem are different solutions. Put a check (✓) before the best solution or solutions to the problem (9).

(a) Mrs. Cruz has three children: Carmen, Jose, and Ana. Carmen, the eldest, caught influenza possibly from one of her classmates. Ana and Carmen sleep in the same room under one mosquito net. How can Mrs. Cruz prevent the spread of influenza to her other children?
(1) Ask Ana and Jose to sleep in the next house.
(2) Allow Ana to sleep with Carmen so she can take care of her sick sister.

(3) Place Carmen in a corner of the room and let her sleep by herself without a mosquito net.
(4) Ask Ana to sleep in another room and allow Carmen to use the room alone.
(5) Avoid all possible contacts between Carmen and the other children. Mrs. Cruz alone should attend the sick child.

(b) What should Mrs. Cruz do to help her child recover from her illness as soon as possible?
(1) Report the case to the school physician, nurse, or to the doctor at the Health Center for proper advice and treatment.
(2) Buy a medicine advertised in the newspapers or radio and give it to her sick child.
(3) Get some of the local medicinal plants and give it to the sick girl.
(4) Ask her neighbors what medicine they give their children when they have fever.
(5) Call an "herbolario."

(c) The Santos family is very poor. Mrs. Santos could not even buy mosquito nets for her children. One day Mr. Santos got sick. The town physician found out he had malaria. What things should Mrs. Santos do to prevent the spread of malaria?
(1) Cover all standing water with soil.
(2) Take Mr. Santos to the hospital.
(3) Build smudges to drive away the mosquitos.
(4) Secure mosquito nets and sleep under them.
(5) Give the patient the necessary medicine.

(d) In a certain locality there is an epidemic of dysentery. Mr. Reyes and his family are living in that locality. However, none of the members of Mr. Reyes' family has as yet caught the disease. What should Mr. Reyes do to protect the members of his family?
(1) Drink only safe or boiled water.
(2) Sleep under mosquito nets.
(3) Keep all foods covered and protected from flies.
(4) Have all the members of the family inoculated against dysentery.
(5) Remind all the members to take a bath every day.

(e) Rosita woke up with a bad cold one morning. She was feeling weak and had clogged nose and watery eyes. What should she do to protect her classmates?
(1) Go to school but stay under the sun.
(2) Stay in bed and rest.
(3) Dispose all paper tissues soiled by discharges carefully.

(4) Take plenty of fruit juice.
(5) Play with her classmates in the open air.

(f) Mrs. Luna noticed that her baby had a slight fever when they came home from the park one afternoon. She recalled the people they met and talked to at the park. "Could one of them possess an evil eye?" she thought. She didn't know what to do. If you were Mrs. Luna, what will you do?
(1) Give the baby a good bath.
(2) Call Mang Pedro who can do the "tawas" treatment for children.
(3) See an "herbolario" who knows about medicinal plants.
(4) Consult a physician.
(5) Give her baby one of the "wonder" drugs.

3. Directions: Below are some safety hints. Some of them are right and the others are wrong. Read each of them carefully. If the safety hint is right, underline the letter R. If the safety hint is wrong, underline the letter W and the part which makes it wrong.

R W (a) In case one's clothing catches fire, the best thing to do is to run for help.
R W (b) A person who takes medicine which has not been prescribed for him by a doctor is taking a risk.
R W (c) To be able to ride a bicycle well, one has to practice riding it in a busy street.
R W (d) Before taking any medicine, it is best always to stop and read the label twice.
R W (e) Crossing a street at the corner causes more accidents than crossing it elsewhere.
R W (f) A large vacant lot over which electric wires are strung is a good place for flying a kite.
R W (g) One cause of fire is carelessness in handling matches and cigarettes.
R W (h) The best medicine to apply on a burned area of our skin is iodine.
R W (i) Fire drills are held in the school to help the pupils form the habit of doing the right thing when there is a real fire.
R W (j) The railroad track is a safe place for walking because it is free from autos and trucks.
R W (k) Alcohol and gasoline should be kept out of the reach of children.
R W (l) Keeping our heads out the window when we are riding in a bus will help us get more fresh air.

R W (m) In crossing a street , we do not have to wait for the green lights.

R W (n) One can learn to swim better if he practices alone.

R W (o) The best time to go swimming is right after lunch.

R W (p) Replacing immediately defective electrical or gas appliances is poor economy.

R W (q) Prescription drugs which have not been completely used must be saved for future use.

R W (r) Schools and homes must be regularly inspected for safety.

R W (s) Always hand a knife to another person with the point turned away from you.

R W (t) Disconnecting all electrical appliances after using them is a waste of time and effort.

D. Analysis, interpretation, and extrapolation

Directions. The chart below presents the ten leading causes of death in the Philippines, five-year average (1955-1959) and 1960. Study the data given then write after the number on the answer sheet corresponding to that of each statement:

A if the information given in the chart is sufficient for you to think that the statement is definitely true.

B if the information given in the chart is sufficient only to indicate that the statement is probably true.

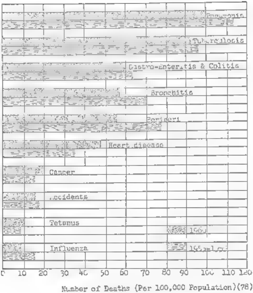
C if the information given in the chart is not sufficient to indicate any truth or falsity in the statement

D if the information given in the chart is sufficient for you to think that the statement is probably false.

E if the information given in the chart is sufficient for you to think that the statement is definitely false.

(See chart on the next page)

1. The major causes of deaths in the Philippines are infectious diseases.
2. Great progress has been made in the control of infectious diseases in the Philippines since 1955.
3. Public health measures have improved during the last ten years.
4. There were less people who died of heart disease in 1960 than in the five-year average (1955-1959).
5. During World War II, the leading cause of death in the Philippines was malaria.



Ten Leading Causes of Death in the Philippines
Five-year Average (1955-1959) and 1960

6. No control measure can reduce the number of deaths from infectious diseases in the country in the years to come.
7. Less people died from cancer in 1960 than in years previous to it.
8. Infectious diseases will continue to be the leading causes of deaths in the Philippines many years from now.
9. Progress in medicine and control measures have been chiefly responsible for the decrease in respiratory and intestinal diseases.

10. No deaths from smallpox have been reported in the Philippines from 1955-1960.

E. Drawing a reasonable conclusion and making inferences.

1. Great progress has been made in the control of communicable diseases in the Philippines. 2. The leading
cause of death in the country in 1910 was malaria.
3. In 1960 it accounted for less than six deaths per
100,000 population. 4. In 1906 cholera was the fourth
most fatal disease in the Philippines. 5. In 1960 no
deaths from cholera were reported. 6. No deaths from
smallpox have been reported also from 1950 to 1960.
7. Fatal cases of dysentery dropped from 107 per
100,000 population in 1906 to 1.4 per 100,000 in 1960.
8. Deaths from typhoid have been reduced from 38.6 per
100,000 in 1906 to 0.3 per 100,000 in 1960 (78).

Directions: Choose and write or your answer sheet the conclusion which you think is most consistent with the facts given above.

1. More people die of malaria in the Philippines than of any other disease.
2. The number of deaths from communicable diseases in the Philippines will continue to increase.
3. It is possible to reduce to zero the number of deaths from communicable diseases in the Philippines.
4. There will be no more deaths from smallpox and cholera in the Philippines.

Directions: Write the number of the sentence or sentences that will support your conclusion.

F. 1. Judgment test

Directions: Below are some health practices. Which of them are desirable and which are undesirable? Write U after each undesirable habit and underline the undesirable part. Write D after each desirable habit (9).

(a) Wash tomatoes with soap and clean water before eating them raw. _____
(b) Keep cooked food covered when you are not yet ready to eat. ____
(c) Cook vegetables until they are very soft to be sure they are thoroughly cooked. ____
(d) Eat sweets all the time. ____
(e) Eat plenty of vegetables and fruits. ____
(f) Select foods for their nutritive value. ____

(g) Keep drinking water in clean containers. ____
(h) When you are not sure that the source of your drinking water is safe and clean, boil the water. ____
(i) Wash drinking glasses before using them. ____
(j) Avoid drinking plenty of water after eating. ____

2. Evaluation

Directions: Below are statements of beliefs and practices of some people about illnesses and diseases. If you agree with the statement, circle the A; if you disagree, circle the D; if you are uncertain, circle the U.

A U D (a) A "mangkukulam" can make a person sick.
A U D (b) Some diseases simply arise out of "bad" air.
A U D (c) Many diseases are caused by germs and can be prevented.
A U D (d) Only "novenas" and prayers can control and prevent epidemics.
A U D (e) The hospital is a place only for people who are seriously ill.
A U D (f) People who are clean and careful in their eating habits are more susceptible to disease than those who are not.
A U D (g) No antibiotic or sulfa drugs should be taken by a person unless it is prescribed by a physician.
A U D (h) Any of the "wonder" drugs may be taken for any kind of disease.
A U D (i) The best way to prevent communicable diseases is to build body resistance and to practice habits of good personal hygiene.
A U D (j) Children who have severe colds must stay home.
A U D (k) School children must be prohibited from buying food from outside vendors.
A U D (l) A person's feelings should not be hurt if he is isolated every time he gets sick with a communicable disease.
A U D (m) All school children must be given a physical and health examination every year.
A U D (n) Everyone must be given smallpox, anti-typhoid-cholera-dysentery, and other types of immunization.
A U D (o) Medical certificates must be required from children who have been sick with communicable diseases.
A U D (p) Grade I children who are seeking admission to the public schools must undergo health and physical examination before they are enrolled.

3. Evaluation

Directions: Below are some personal practices. Read each one carefully and find out if it is desirable or undesirable practice. Copy all the undesirable ones and under each write your reason or reasons for marking it undesirable. The example below shows what you will do (9).

Example. Stay up at night as late as you wish to so that you will sleep soundly when you go to bed.

This practice will not give a child the required hours of sleep and so he will not grow well. He will be nervous and sickly.

(a) Have a regular time to go to bed.
(b) Drink plenty of coffee before going to bed.
(c) Smoke cigarettes at least once a day.
(d) Exercise daily in the open air.
(e) Play indoors where it is safe.
(f) Eat fast enough so that you will not stay long at the table.
(g) Sit, stand, and walk erect.
(h) Eat bulky foods.
(i) Eat between meals so that you will not be hungry before the next meal comes.
(j) Cover your nose and mouth when you are on a dusty road.

4. Evaluation

You have fifteen centavos (15¢) to buy your recess lunch. You found the following foods sold at the lunch counter. What will you buy? Give reasons for your choices.

Sandwich - 10¢
Calamansi juice - 5¢
Milk - 10¢
Turnip - 5¢
Orange - 5¢
Candy - 5¢
Cake - 15¢
Fried camote - 5¢
Soup - 10¢
Boiled peanuts - 5¢
Chewing gum - 10¢
Cookies - 5¢
Coca cola or other soft drinks - 15¢
Green mango with bagoong - 5¢

G. 1. Ability to locate and identify facts, observations, problems, hypotheses, and conclusions
2. Ability to support conclusions formed (57)

Directions: Read the following selection carefully, then answer the questions given under it. Write on your answer sheet only the number of the sentence or sentences indicating your answer.

The Discovery of Penicillin

1. In 1929, Dr. Alexander Fleming raised a certain kind of bacteria called _staphylococcus aureus_. 2. These bacteria normally grow well in colonies or clusters on agar.

3. One day, Dr. Fleming noticed that a large colony of mold had grown in one of the agar plates of bacteria. 4. When he observed the mold more closely, Dr. Fleming discovered that immediately surrounding the mold colony, there was a clear zone indicating that the growth of bacteria had been checked or inhibited in the area. 5. He was puzzled. 6. Why didn't bacteria grow near the mold? 7. Could the mold have killed or checked the growth of the bacteria? 8. Dr. Fleming became curious. 9. He isolated the mold and studied its activities. 10. After careful experimentation, he was convinced that the mold gave off a substance that killed and checked the growth of the bacteria, _staphylococcus aureus_. 1. Because he identified the mold to be _Penicillium_, Dr. Fleming called the antibacterial substance it produced, _Penicillin_.

(a) Which sentence or sentences
   (1) states a _fact_? (Something that Dr. Fleming already know.)
   (2) states an _observation_? (Something that Dr. Fleming saw.)
   (3) states a _problem_? (Something that puzzled Dr. Fleming.)
   (4) states a _hypothesis_? (Something that Dr. Fleming predicted.)
   (5) states a _conclusion_? (Something that Dr. Fleming decided on the basis of what happened.)

(b) Is penicillin capable of killing or checking the growth of any kind of bacteria? Yes No
Which sentence or sentences will support your answer?

Essay Tests

A. Selective recall
   1. There are many ways of preventing the spread of communicable diseases. Discuss them. The following pointers will guide you in your discussion.
      (a) What are communicable diseases? Give some common examples.
      (b) How is each spread?
      (c) What can we do to prevent the spread of communicable diseases?

   2. What important food materials are needed by the body? Discuss why each is necessary for body growth and good health.

3. What are some of the common causes of accidents and how can we prevent them?

4. In what ways can we improve or maintain our health through temperance?

B. Evaluative recall
   1. What beliefs and practices about illnesses do you think are erroneous? Give your reasons.

   2. Why is water important to you?

   3. Why is a thorough knowledge of first aid treatments important?

C. Causes and effect
   1. Why are vitamins important to good health?

   2. Why is it important for our glands to function properly?

   3. Why are clean and safe surroundings important to good health?

D. Comparison
   1. Compare the human body with a machine. In what ways are they alike and different from each other?

   2. Compare the use of some medicinal plants with certain commercial drugs or medicine.

E. Explanation
   1. Explain the importance and the proper use of "wonder" drugs.
   2. What will you do if you fall and bruise yourself?
   3. Tell what you will do in case your clothes catch fire.

F. Analysis

If you were asked to plan a day's menu for a certain family, what factors will you consider in planning the menu? Explain.

G. Classification
   1. How will you classify foods according to body use?
   2. How will you classify the different organs of the body according to use?
   3. How will you classify burns according to depth of injury?

H. Application

Plan a day's menu for you. Explain why you selected the foods you included in the menu.

I. Discussion
   1. Why is it important to eat only clean foods?
   2. Discuss the importance of the discovery of the X-rays.

3. What other kinds of diseases aside from communicable diseases affect the different organs of the body? Discuss their causes and prevention.

J. Outline

The foods that you eat during mealtime go through a long process before they can be used by the cells of the body. In outline form write what happens to the foods from the time they are taken into the mouth to the time they are taken to the cells of the body.

K. Criticism

What is wrong with this menu?

Boiled rice
Fried chicken
Fried potatoes
Cake
Ice cream

Performance Test

Show the class how you would do the following.

1. How to stop a nosebleed.
2. How to revive a drowned person.
3. How to treat a dog bite.
4. How to stop bleeding from a wound or cut.
5. How to revive a person who has fainted.

Non-Testing Procedures

I. Keeping a record of health practices

Directions: Keep a record for one week of your practice of the health habits, using the form suggested below. Enter an x opposite the proper item and under the proper date if you performed or followed the rule; an o if you did not.

Health Habits	M	T	W	Th	F	Sat	Sun	Rating
1. Exercise daily in the open air.								
2. Sleep the number of hours required.								
3. Eat meals regularly.								
4. Go to the toilet regularly.								
5. Sleep with windows open.								
6. Sleep under a mosquito net.								
7. Avoid eating between meals.								
8. Have a regular time to go to bed.								
9. Wash your hands after using the toilet.								
10. Avoid smoking and drinking.								
11. Drink plenty of safe water.								
12. Sit, stand, and walk erect.								
13. Keep your body clean.								
14. Find interesting things to do								
15. Rest after periods of work and play.								

II. Agree-disagree inventory

Directions: Below are statements concerning some school practices. If you agree with the practice stated, circle the A, if you disagree, circle the D, if you are uncertain, circle the U.

A U D 1. Prohibiting school children from buying food from outside vendors during recess.

A U D 2. Not selling carbonated drinks in school.

A U D 3. Supervising lunch activities in the rooms.
A U D 4. Encouraging children who have common colds to stay at home.
A U D 5. Requiring all school children to submit to physical and health examinations each year.
A U D 6. Giving smallpox, anti-typhoid-cholera-dysentery injections to school children.
A U D 7. Requiring medical certificates from children who have been sick with communicable diseases.
A U D 8. Not exempting children from the physical education period.
A U D 9. Requiring all children who are seeking admission to public schools to submit to thorough physical and health examinations.
A U D 10. Serving free lunch to school athletes.

III. Use of checklists

A. Below are simple illustrations of abbreviated checklists containing a group of "expected desirable forms of behavior" in the area of health habits. Any one of the three (word, phrase, or sentence) types may be used.

Directions: Check whether the pupil has good health habits for each of the following.

Word Type	Phrase Type	Sentence Type
Teeth	Brushed teeth	He brushes his teeth each morning.
Hair	Combed hair	He combs his hair each morning.
Nose	Cleaned nose	He has a clean nose each morning.
Eyes	Cleaned eyes	He has clean eyes each morning.
Ears	Washed ears	He has clean ears each morning.
Hands	Washed hands	He has clean hands each morning.
Etc.	Etc.	Etc.

B. Below is a type of checklist which may be used in evaluating growth in the development of good health habits.

Checklist for Good Health Habits Grade: VI-3 Teacher: Miss C. Marcas School year: 1966-67 Children's Names	Clean hands	Clean and well-trimmed fingernails	Suitable clothes	Clean and neat clothes	Clean teeth	Clean neck	Clean feet	Clean and suitable footwear	Clean socks	Well-combed hair	Carries a clean handkerchief
1. Alberto, Zoilo											
2. Carlos, Jose											
3. Castano, Gil											
4. Lopez, Francisco											
5. Palanca, Miguel											
6. Portillo, Victorio											
7. Santos, Federico											
8. Tangco, Ruben											
9. Ventura, Rogelio											
10. Vital, Paolo											

C. Directions: Below are some common foods which you may or may not enjoy eating. Read each item and indicate on your answer sheet whether you like it, are indifferent to it, or dislike it.

L means like
I means indifferent
D means dislike

___1. butter
___2. nuts
___3. candy
___4. pastries
___5. cereals
___6. eggs
___7. cheese
___8. fish
___9. milk
___10. meat
___11. chicken
___12. liver
___13. seafoods
___14. beans
___15. tomatoes
___16. green vegetables
___17. yellow vegetables
___18. citrus fruits
___19. other fruits
___20. potatoes

IV. Use of rating scales

A. Self-rating evaluation form

Below is an example of a self-rating evaluation form which may be used in evaluating growth in the area of health habits.

Am I Clean and Well-Groomed?

Directions: Answer each of the following questions by putting a check mark under the appropriate item.

	Always	Usually	Occasionally	Never
1. Is my hair well combed?				
2. Are my teeth clean?				
3. Are my ears clean?				
4. Is my neck clean?				
5. Are my fingernails clean and well-trimmed?				
6. Are my hands clean?				
7. Are my clothes suitable?				
8. Are they clean and neat?				
9. Are my shoes clean and comfortable?				
10. Are my socks clean?				

B. Descriptive self-rating scale

Name: ______________________ Date ______________

Do you	All the time	Most of the time	Occasion-ally	Never
1. cross streets at corners?				
2. walk on sidewalks?				
3. heed traffic signs?				
4. use pedestrian lanes?				
5. look both ways before crossing the street?				
6. walk, not run?				
7. wear or carry something white when walking at night?				

Do you	All the time	Most of the time	Occasionally	Never
8. avoid sitting on the side of the street?				
9. keep from playing on the street?				
10. avoid walking on the railroad track?				
11. keep from riding bicycles or scooters on busy streets?				
12. avoid stealing rides on moving vehicles?				
13. drive close to the curb when you ride your bicycle?				
14. refuse handlebar rides?				
15. keep from hitching to autos, buses, jeepneys, etc.?				
16. skate only on sidewalks?				
17. tie on skates firmly?				
18. avoid pushing or pulling one another				

V. Use of a questionnaire

A. The following questionnaire may be sent to parents to collect evidence regarding children's practice of safety habits outside the school.

Dear Parents:

You and I are interested in __(child's name)___ growth toward safety habits. The purpose of this questionnaire is to know the effectiveness of safety education we are providing your child in school. Please answer the following questions and return it, if possible, by mail to the undersigned. Thank you.

Sincerely yours,

____

Teacher

1. Does he go home right away after classes?
2. If he is walking
    (a) does he cross streets at corners?
    (b) cross only on proper signals?
    (c) look both ways before crossing?
    (d) always use the pedestrian lanes?
    (e) walk, not run?
    (f) always use the sidewalk?
3. If he is riding in a moving vehicle
    (a) does he keep from sticking his arms and head out the window?
    (b) not get off until the vehicle has completely stopped?
    (c) look both ways when getting off?
4. When he plays does he
    (a) stay in the yard or play area?
    (b) wait for his turn, not push?
    (c) avoid playing rough games?
    (d) keep from playing with fires?
    (e) keep from teasing animals?
    (f) keep away from strange animals?
    (g) skate only on sidewalks?
    (h) drive his bicycle close to the curb?
    (i) swim at safe places?
5. At home does he
    (a) put away his things in their proper places after using them?
    (b) walk not run on stairs?
    (c) keep from touching electrical fixtures and appliances with wet hands?
    (d) not run while carrying sharp instruments?
    (e) take special care when using knives and other sharp instruments?
    (f) use a sturdy ladder or step stool to reach high places?

B. Directions: The purpose of this questionnaire is to know some of the things you do outside the school. Since there are no right and wrong answers to the questions, you are to express your honest feelings about them. There are three ways to work your answer sheet.

Y means that your answer to the question is Yes
U means that your answer to the question is Uncertain
N means that your answer to the question is No

Y U N 1. Do you prefer to go swimming alone?
Y U N 2. Will it be fun to swim in areas which you have not been before?
Y U N 3. Do you like to swim when you are overheated or overtired?
Y U N 4. Do you run on stairs when you're in a hurry?

Y U N 5. Do you put away your things in their proper places after using or playing with them?
Y U N 6. Do you touch electrical appliances or fixtures when your hands are wet?
Y U N 7. Do you read the label of medicines twice before taking or applying them?
Y U N 8. Do you put away in safe places poisonous drugs, disinfectants, household cleansers, and exterminators?
Y U N 9. Do you use flammable cleaning fluids?
Y U N 10. Do you not hang your clothes or curtains in places where they may blow into or near flames?
Y U N 11. Do you wipe up spilled grease or water immediately?
Y U N 12. Do you not allow trash to accumulate anywhere in the house?
Y U N 13. Do you store flammable materials safely?
Y U N 14. Do you try repairing electrical appliances or fixtures even if you're not thoroughly familiar with them?
Y U N 15. Do you report immediately cases of leaks in a gas supply?

VI. Informal techniques
  A. For evaluating growth toward safety habits
    1. Anecdotal record of children's growth toward safety habits. Observe and keep a record of safety practices of children such as use of scissors and sharp tools, throwing stones, leaving materials and equipment where they may cause falls, running in halls and on stairs and noting improvement throughout the year. Any of the forms suggested in Chapter III for anecdotal records may be used.
    2. Interview parents, industrial arts, lunch, home economics, physical education, and science teachers regarding the safety habits of children.
    3. Keep a record of how many children have made a survey of safety hazards in their homes and have done something to correct them. Home visitation may be of help here.
    4. Study the attendance records of children to determine absences due to accidents.
    5. Keep a record of injuries children report and note whether they show increasing recognition of the conditions which require the exercise of care.
    6. Ask the Junior Police, the Safety Patrols, or the Boy and Girl Scouts to record violations of safety rules. Compare the records from time to time to note evidence of improvement.

  B. For evaluating growth toward desirable food habits
    1. Analyzing records of foods eaten daily by children (amount and kind).
    2. Interviewing parents regarding the food habits of children.

3. Examining the records of the sale of milk, fruits, carbonated drinks, candies, etc. in the school cafeteria.
4. Listening to children's discussion of foods they like and dislike.
5. Determining if children appreciate variations in height and weight gains among their own groups through analysis of individual height-weight graphs.
6. Observing periodically methods of food handling employed by children working in the school kitchen.
7. Determining changes in food practices through periodic pupil reports such as "What I Ate Last Week."

C. For evaluating growth toward desirable health habits.
   1. Interviewing parents regarding the health habits of children.
   2. Examining children's health records and reports from physicians, dentists, and nurses.
   3. Visiting homes of children to determine the healthfulness of surroundings and steps taken by the children to improve unhealthful conditions.
   4. Studying the attendance records to determine the illnesses that keep children from school.
   5. Observing and recording from time to time the behavior of children with reference to sneezing, using a handkerchief, putting things in their mouths, eating without washing the hands, and using drinking cups.
   6. Taking note of the reactions of children toward immunization when it is done at school -- whether there is evidence of greater acceptance and understanding.
   7. Observing and taking note of children who use common combs, drinking glass, or wear each other's clothes and footwear.
   8. Observing periodically methods of food handling employed by children working in the school kitchen.
   9. Noting the number of children who voluntarily see their physicians at regular intervals for treatment or to obtain health examinations.
   10. Taking note of children who buy foods from peddlers or outside vendors.
   11. Determining if children appreciate variations in height and weight gains among their own groups through analysis of individual height-weight graphs.
   12. Collecting evidence from parents regarding children's hours of study, work, and recreation, and noting if the time for study, work, and recreation fit into a well-balanced and healthfully scheduled day and week.
   13. Encouraging children to keep a diary of their daily activities and analyzing the diaries to see the success of stressing a health attitude.
   14. Taking note of the spontaneous expressions of health ideas and understandings of body structure and growth.

APPENDIX F

EVALUATIVE DEVICES AND PROCEDURES FOR APPRAISING GROWTH TOWARDS THE SPECIFIC BEHAVIORAL OBJECTIVES THAT PERMEATE THE FIVE EXPERIENCE AREAS SUGGESTED IN THE PHILIPPINE COURSE OF STUDY

Sample Anecdotal Records

Form A

A record of children's growth toward the ability to think critically. (Use of the "coding technique.")

Name of Pupil	School Year 1966-67			
	7-20	7-21	7-24	etc.
1. Jose Cruz	I-c			
2. Felicidad Barcelona		I-f		
3. Encarnacion Guillermo		I-d		
4. Malquiades Mangay	I-j			
5. Josefina Navarro			I-a	
6. Melencia Isla			I-i	

The record shows that on July 20, Jose showed evidence of the ability to apply known principles, Malquiades, the ability to preceive causes and effect relationship. On July 21, Felicidad was able to explain the relationship among some given data, Encarnacion was able to formulate and support a valid conclusion, etc. For explanation of the use of the coding technique, see page 65 of Chapter III. The code numbers entered (I-c, I-j, I-f, etc.) represent the specific reactions under specific behavior I- Do critical thinking on page 165, Chapter V.

Form B

A record of children's growth toward the ability to solve problems scientifically. (Use of the descriptive technique.)

June 12, 1965

Experiment 12 -- Plant Growth

Children's Initials	Reactions Observed
F. C.	Stated the problem clearly for the group.
J. V.	Suggested experimenting with three kinds of soil.

D. M.	Planted the corn grains without much help. Spaced them evenly. Careful and accurate in measuring the water used.
	July 27 - July 30
M. T.	Observed the plants regularly. Accurate in measuring the heights of the growing plants. Kept accurate records of observations made.
	August 15
C. L.	Stated a good conclusion. Proposed checking the results of the experiment.
R. M.	Suggested repeating the experiment.
J. N.	Suggested checking the results against information found in science and social studies texts.
A. T.	Suggested consulting the garden teacher.

Form C

A record of a child's growth toward the ability to observe carefully and record observations accurately. (A combination of the check-list and descriptive technique.)

No. ____ Child's Name: Ben Lopez Behavior Objective. Ability to observe carefully and record observations accurately.	Months: J F M A M J J A S O [✓ N] D Days: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 [✓ 27] 28 29 30 31
Noted differences in: (Indicate with a check.) ✓ 1. size of trees ___ 2. type and growth of stems and branches ✓ 3. type and texture of barks ✓ 4. shape, color, size, and number of leaves	Continued observing long after the others had stopped. Noted differences not only in the size and shape of leaves but also in edges and texture. Recorded observations accurately.

✓ 5. flowers -- color, size scent, growth (single, clusters, etc.)

✓ 6. fruit -- color, shape, size, growth (pods, clusters, etc.)

____ 7. other characteristics (folds leaves at night, sheds leaves, etc.)

This anecdotal record shows that the teacher observed and recorded the behavior of Ben Lopez on November 27. At a glance the teacher will readily know that the record pertains to accuracy of observation and recording. The behaviors that were checked were observed and noted. Other evidences of desirable behavior not in the list were jotted down (see observations noted on the right hand column).

Form D

A record of children's growth toward the development of science interest, open-mindedness and a feeling of responsibility. (Recording remarks verbatim.)

Date	Place	Comments
August 2, 1965	Classroom	Jose: I made a bird feeder yesterday. I hope many birds will come to it.
August 2, 1965	Classroom	Paolo. I've never seen fishes with light organs, but I suppose there might be some.
August 2, 1965	Lunch counter	Ofelia: I'd rather buy an orange and some boiled peanuts instead of candies.

This record indicates precisely what the children said. To write down children's remarks verbatim, some teachers make use of a tape recorder during class discussion.

Form E

A record of a child's growth toward the development of appreciation for the world in which she lives. (Use of the "log.")

Examples of entries in a teacher's log book.

September 18	Teresa stepped on an earthworm she saw on the ground. She said she didn't like the sight of them and she's glad the birds eat them.
September 29	In her report about the use of fertilizers, Teresa reported about the work of earthworms. She remarked she didn't realize they could be that helpful.

Checklists

Form A

A checklist for evaluating growth toward voluntary use of multiple resources.

Directions: Complete the following checklist by checking the steps you have taken in your study of ______________________.
(name of unit)

______ Read the textbook

______ Consulted one reference book

______ Consulted two references

______ Consulted three or more references

______ Read other resource materials such as pamphlets, brochures, magazine articles, etc.

______ Referred to the vertical files in the library

______ Viewed films and slides

______ Conducted experiments

______ Wrote to government and civic agencies

______ Watched educational TV programs

______ Interviewed competent persons

______ Joined study tours

______ Made careful observations

Form B

A checklist for evaluating growth toward the ability to solve problems scientifically.

	Names of Pupils																	
Desirable Pupil Reactions	Jose Reyes	Victor Santos	Luis Ylagan															
Participated actively in identifying and stating the problem.																		
Helped the class to qualify the wording of the problem.																		
Identified himself with the problem.																		
Suggested effective methods for solving the problem.																		
Voluntarily used resources such as books, authorities and audio-visual aids to gather data that were helpful to the solution of the problem.																		
Drew tentative conclusions.																		
Questioned validity of conclusions formed.																		
Looked for sources of authoritative evidence to check the validity of conclusions formed.																		
Was satisfied with the results he got from his problem-solving methods.																		
Used the vocabulary developed in the problem																		
Continued independently to explore further related problems.																		

Form C

A checklist for evaluating growth toward the ability to do experiments as a part of solving problems scientifically.

	Names of Pupils														
Desirable Pupil Reactions	Elena Garcia	Lita Porelas	Fe Cru												
Identified the purpose for which an experiment is needed.															
Suggested original experiment.															
Proposed controls for the experiment.															
Shows resourcefulness in suggesting substitute materials when those needed in the experiments are not available.															
Shows interest in and reasonable skill in performing experiments.															
Manipulates science equipment satisfactorily.															
Is accurate in one's measurements.															
Can predict the outcome of an experiment and could justify his predictions.															
Makes accurate records of the experiment.															
Draws justifiable conclusions.															
Questions validity of conclusions formed.															
Suggests repeating the experiment to check whether or not the same results will be obtained.															
Looks for sources of authoritative evidence to corroborate the results of the experiment.															
Applies what he has learned to interpret a new situation.															

Form D

A checklist for evaluating growth toward the development of curiosity and interest in one's environment

	Names of Pupils						
Desirable Pupil Reactions	Angel David	Ruben Marcos	Carlos Laurel				
Reacts positively to new and strange elements in his environment.							
Exhibits a need to know more about himself and his environment.							
Scans his surroundings seeking new experiences.							
Persists in examining and exploring things new to him in order to know more about them.							
Keeps working a long time trying to understand anything new which can be examined.							
Sticks to problems trying to solve them.							
Last to give up when the class is looking for answers to questions.							
Keeps asking questions after everyone else has stopped.							
Looks for additional materials to read aside from those suggested in the unit.							
Continues to work on projects taken up in connection with the unit after the class has moved to other experience areas.							
Is curious and absorbed in his observation when the class is taken on study tours.							
Is able to note more subtle characteristics and differences among the things or objects he observes.							

Form 2

A checklist for evaluating growth toward the development of open-mindedness and a feeling of responsibility and appreciation.

	Names of Pupils														
Desirable Pupil Reactions	Solita Flores	Violeta Calizo	Leticia Ong												
Which children															
1. made spontaneous statements as to the value of a) our natural resources? b) the inventions and discoveries scientists have contributed to our lives?															
2. gave evidence of the recognition of the beauty and wonders of nature--the ingenious ways by which plants propagate themselves; the mechanism and growth of the human body; the great variation, balance, and harmony that their environment exhibits, etc.?															
3. engaged in discussion which shows they understand that man is dependent upon plants and animals for food and other things in life?															
4. showed concern for protecting plant and animal life and in providing for their needs?															
5. used expressions such as "maybe this happened because," "it appears to be," "it could be that," "I think," and the like?															

Questionnaire and Inventories

Form A

An inventory for evaluating growth toward the development of a feeling of responsibility.

Questions	Yes	Uncertain	No
1. Do I watch for news of discoveries?			
2. Am I more careful in reading instruments and more accurate in recording my readings?			
3. Am I becoming more responsible about remembering to do something I have agreed to do?			
4. Do I take responsibility for certain parts of a committee report willingly?			
5. Do I carry out my share of the project we have planned?			
6. Do I offer to help others in carrying on our work?			
7. Do I label the source of information that I contribute in discussions and in written work?			
8. Do I challenge questionable information given by others and accept challenges of my own explanations good naturedly?			

Form B

A questionnaire for evaluating growth toward the development of open-mindedness and a feeling of responsibility.

"Who's Who?"

Directions: Is there anyone in our class like this? If there is, put that person's name under the description. If you think of more than one person, write these other names also. If there is nobody in our class like this, write "nobody" and go on to the next item.

1. Listens to and considers the ideas and suggestions of others.

2. Is willing to check his ideas anytime.

3. Changes his ideas when new and good evidences are presented.

4. Does not jump to conclusions or make decisions on the basis of one observation.

5. Is aware that not all printed matter is accurate.

6. Refuses gossip, hearsay, or rumor as a source of information.

7. Does not allow his decisions to be affected by his personal likes or dislikes, anger, fear, and ignorance.

8. Recognizes that there are specialists in the area under consideration.

9. Labels the source of information he contributes in discussions and in written work.

10. Challenges questionable information and accepts challenges of his own explanation good naturedly.

Form C

An inventory for evaluating growth toward the development of a feeling of responsibility to oneself.

Directions: For each of the activity listed below

1. Mark an x in Column I of your answer sheet if you perform the activity without being told or reminded to do it.
2. Mark an x in Column II of your answer sheet if you perform the activity only when told or reminded to.
3. Mark an x in Column III of your answer sheet if you do not perform the activity.

1. Take a bath or shower every day
2. Exercise or play outdoors daily
3. Brush your teeth after each meal
4. Keep your fingernails and hands always clean
5. Sleep the number of hours required of your age
6. Wear clean and suitable clothes
7. Sleep with windows open
8. Read with adequate light
9. Eat fruits and vegetables
10. Drink milk, fruit, or vegetable juice
11. Eat eggs, butter, or cheese
12. Eat meat, fish, and seafoods
13. Drink plenty of clean water
14. Follow safety rules
15. Visit a dentist at least once a year
16. See a doctor when you are sick and for physical check-up
17. Wash and brush your hair regularly

Form D

An inventory for evaluating growth toward the development of science interests, appreciation, and a feeling of responsibility.

Directions The purpose of this questionnaire is to know what you really think about the lessons you are studying in your science classes. Since there are no right and wrong answers to the questions, you are to express your honest feelings about them. There are three ways to work your answer sheet.

Y means that your answer to the question is Yes

U means that your answer to the question is Uncertain

N means that your answer to the question is No

1. Have you learned all that you want to know about the solar system and the universe?
2. Do you want to read additional materials about magnetism and electricity? about mechanical and electrical devices?
3. Were the lessons on insects and other animals important to your life?
4. Do children need to know the structure and care of the human body?
5. Do you want to do more experiments with plants?
6. Will you be interested in planting and keeping a garden for yourself?
7. Would you want to keep an aquarium?
8. Do you want to own a birdhouse and take care of birds?
9. will it be fun to hunt for birds' eggs and birdies?
10. Should our fishing laws be enforced at all times?

Form E

An inventory for evaluating growth toward the development of appreciation for the tools and techniques of science.

Directions: Below are some ways of working which you have learned in your science classes. Mark U if you think it is useful and needs to be practiced; H if you think it is helpful but need not always be practiced, N if you think it is not useful and hence need not be practiced.

U H N 1. Making careful and intelligent plans before solving a problem.

U H N 2. Trying all possible ways of solving a problem.

U H N 3. Forming conclusions only after sufficient data or evidence have been collected.

U H N a) Using different resources in gathering information needed for the solution of a problem.

U H N b) Performing experiments to gain information useful in solving a problem.

U H N c) Checking the reliability of the sources or the authorities you consult for information.

U H N d) Trying to be accurate in your measurements.

U H N e) Predicting the outcome of an experiment.

U H N f) Making accurate records of your experiment.

U H N g) Repeating experiments to check if you get the same results.

U H N 4. Looking for authoritative sources to check your conclusions.

U H N 5. Recording your observations carefully.

Form E

An inventory for evaluating growth toward the development of science interests.

Directions: As you read each item below underline one of the four letters after the number of that item on the answer sheet.

- S - if you feel you do get satisfaction from performing the activity
- U - if you are uncertain as to your reaction to performing the activity
- D - if you feel you do not get satisfaction from performing the activity
- X - if you have never performed the activity

1. Performing science experiments in school or at home.
2. Reading news and articles about new science developments.
3. Joining observation tours to places of interest and information.
4. Viewing science films and slides.
5. Watching science programs on TV.
6. Collecting specimens.
7. Participating in science fairs and class exhibits.
8. Performing science demonstrations.

9. Constructing models and other kinds of science projects.

10. Reading science books and references.

11. Participating in health, conservation, and beautification campaigns.

12. Participating in class discussions, committee reports, or group projects in science.

Form G

An inventory for evaluating growth toward the development of appreciation for the contributions of science to our daily lives.

Directions: In this inventory you are asked to express your reactions to the opinions expressed in the statements. Read each statement carefully. Then indicate your reactions on the answer sheet by underlining one of the three letters after the number of the item.

A - if you agree with the opinion expressed in the statement
U - if you are uncertain whether you agree or disagree with the opinion expressed in the statement
D - if you disagree with the opinions expressed in the statement

1. The exploration of space has no great nor immediate influence on our daily lives.

2. The work of an entomologist does not contribute much to man's life.

3. The discovery of the nature and cause of communicable diseases is important to all of us.

4. A knowledge of the heavenly bodies is important only to astronomers.

5. The exploration of ocean floors is a waste of time and money.

6. The contributions of science in improving the quality and quantity of farm products is important not only to the farmers but to all of us.

7. Men have learned everything there is to learn about body illnesses, their prevention, and cure.

8. The invention of air and ocean vehicles are helpful only to those who travel.

9. The world would be a better place to live if atomic energy had not been discovered.

10. The discovery of electricity has improved very much our ways of life.

Rating Scales

Form A

A self-rating scale for evaluating growth toward voluntary use of multiple resources and ability to select reliable sources and authorities for information.

Do I	All the time	Most of the time	Occasionally	Never
1. consult more than one reference material in my preparation for the discussion of a topic?				
2. interview and/or listen attentively to resource persons invited?				
3. view films and slides, look for pictures; join in and am observant during study tours?				
4. ask for the source or sources of the information before accepting it?				
5. consult up-to-date reading materials?				
a) check the date of the publication of source materials before using them?				
6. consult reading materials of reliable authorship?				
a) inquire about the qualifications of the authors of books I read?				
7. distinguish between science books that are read for fun and those that are read for reliable information?				
8. distinguish between opinions and facts?				
9. show awareness that printed matter is not always accurate?				

Form A (continued)

Do I	All the time	Most of the time	Occasionally	Never
10. detect propaganda?				
11. interview persons who are qualified in the field in which information is sought?				
12. label the source of information I contribute in discussions and in written work?				

Form B

A graphic rating scale for evaluating growth toward the ability to solve problems scientifically.

1	2	3	4	5
Always resourceful in suggesting substitute materials needed in the experiment.		Usually resourceful in suggesting substitute materials needed in the experiment.		Is not resourceful in suggesting substitute materials needed in the experiment.
Always accurate in his measurement.		Usually accurate in his measurement.		Frequently inaccurate in his measurement.
Always checks results of experiment.		Usually checks results of experiment.		Does not check results of experiment.
Always makes accurate records of the experiment.		Usually makes accurate records of the experiment.		Does not record or makes inaccurate records of the experiment.
Always checks results of experiments with authoritative sources.		Usually checks results of experiments with authoritative sources.		Does not check results of experiments with authoritative sources

Form B (continued)

1	2	3	4	5
Always applies what he has learned when he interprets a new situation.		Usually applies what he has learned when he interprets a new situation.		Cannot apply what he has learned when he interprets a new situation.

Form C

A self-rating scale for evaluating growth toward the development of a feeling of responsibility.

Do you	Always	Usually	Occasionally	Never
1. remove plants or parts of them, animals, or other objects from the environment only with permission of the owner involved?				
2. collect only those specimens which are absolutely needed for the study?				
3. replace the soil and the plant you used when the study is completed?				
4. collect more than one or two samples of the specimen needed by the class?				
5. bring materials to class when you promise to?				
6. offer to assist in cleaning up?				
7. handle animals and plants gently so as to avoid injuring them?				
8. get the necessary information for the proper care and needs of the specific animals or plants before taking them to school for observation?				

Form C (continued)

Do you	Always	Usually	Occasion-ally	Never
9. provide proper habitats, food, and water for animals and plants which you keep in school for observation?				
10. return plants and animals to natural habitats once the observations have been completed?				

Form D

A rating scale for evaluating growth toward the ability to manipulate science equipment satisfactorily. (Use of the microscope.)

	Always	Sometimes	Never
1. Handles the microscope properly and with great care.			
2. Cleans the lenses carefully using suitable materials.			
3. Focuses the microscope with reasonable skill.			
4. Prepares slides or materials for observation properly using techniques most suitable to whatever is being examined.			

Form E

A rating scale for evaluating attitude toward beliefs and practices. (Interest in looking for explanation of natural phenomena.)

Directions. The following statements represent opinions that you often hear. Indicate how you feel about each statement immediately after you read it. Do not pause too long on any one of them. Mark your answer sheet as follows:

A - believe strongly

B - believe but interested in more evidence

C - uncertain about it

D - do not believe at all

1. A tree planted during the full moon will bear plenty of fruit.

2. Owls bring bad luck.

3. Floods and earthquakes are punishments from God.

4. A conceiving woman who develops a strong liking for the fruit of a certain tree will cause that tree to be sterile or to bear sour fruit.

5. Comets are harbingers of war, famine, or pestilence.

6. Rains on the first day of May mean bountiful harvest during the year.

7. A "mangkukulam" can make anybody who displeases her sick.

8. Bamboos and trees should be cut when the moon is beginning to wane so that they will remain durable and resistant to weevils.

9. When a black cat crosses your way your're likely to meet an accident.

10. Make a wish every time you see a shooting star and it will come true.

Form F

A rating scale for evaluating growth toward the development of science interest.

Things I Have Done This Year Because I am Interested	Never	Few Times	Sometimes	Many Times
1. Spent extra time on the science homework because I like it.				
2. Observed and studied ____ (plants, animals, weather, etc.) because I like it.				
3. Performed science experiments because I like to.				

Form F (continued)

Things I Have Done This Year Because I Am Interested	Never	Few Times	Sometimes	Many Times
4. Volunteered to answer questions in science class because I'm interested in the topics.				
5. Read additional science books and magazines in addition to those assigned because I'm interested.				
6. Collected specimens because I'm interested.				
7. Indulged in some science hobbies because I like to.				
8. Participated actively in class exhibits and science fairs because I'm interested.				

Form G

A rating scale for evaluating attitude toward the development of appreciation for the value of natural resources.

Directions: The following statements represent opinions that you often hear. Indicate how you feel about each statement immediately after you read it. Do not pause too long on any one of them. Mark your answer sheet as follows:

A - believe strongly

B - believe but think it is not urgent

C - uncertain about it

D - do not believe at all

1. Forest laws should be strictly enforced.
2. Use of dynamite should be heavily penalized.
3. Government funds must be set aside for solving problems of soil erosion.

4. Not enough attention is given to protect our birds and wildlife.

5. Adequate funds must be set aside for the development and maintenance of parks and places of natural beauty.

6. Pollution of air and bodies of water must be heavily penalized.

7. Insecticides should be used with caution.

8. Exploitation of mineral resources should be strictly controlled by the government.

9. Economy in the use of water and electricity must always be observed.

10. Farms and gardens must be continuously fertilized.

Form H

A rating scale for evaluating growth toward the development of science interests.

Do you	Very Much	Moderately	A Little	Not at All
1. like and enjoy reading science books, magazines, and news articles?				
2. enjoy reading science fiction?				
3. like to read about scientists and inventions?				
4. make collections, play science games, own science toys and equipment?				
5. see science films, watch science TV programs, go to science fairs, museums, and planetariums?				
6. enjoy science field trips and study tours?				
7. pursue science hobbies?				
8. participate actively in science fairs and class exhibits?				

Home (continued)

Do you	Very Much	Moderately	A Little	Not at All
9. enjoy reporting and talking about scientific news, things, and events?				
10. do experiments at home?				

Informal Techniques

1. Stimulate pupil responses in the form of discussion by: (1) reading a part of a magazine article, a news article, or a letter, (2) reading an advertisement, (3) reading a report, (4) showing a movie, (5) showing a TV show, (6) presenting a poster, (7) conducting an experiment. Listen to children's reactions and record evidences of critical thinking. A tape recorder may be used during the class discussion.

2. Ask children to note down and report to class inaccuracies they hear in radio and TV programs. Give children opportunities to discuss their thinking about the inaccuracies reported.

3. Encourage children to collect advertisements or report to class advertisers who broadcast non-scientific claims about their products.

4. Encourage children to rate the books, articles, comics, radio, TV programs, movies, trips, and other experiences related to science that they have had at the end of each week as to the usefulness and satisfaction they give. Ask them to give reasons for their judgment. This will give children opportunities to practice critical thinking which should lead them to be selective in choosing which they do.

5. Ask the children to complete or tell stories about a given situation or picture. Give the following directions:

    This is a test of creative imagination. I am going to show you some pictures. I want you to compose a story about each picture. Describe what is wrong with what you see in the picture, what may be done, or what the outcome may be. The following are descriptions of pictures which may be used:

    a) A busy street showing a child stealing a ride, some people not using the pedestrian lane in crossing the street, a boy on a bicycle, a child sticking his head out of the window of a bus, some children playing on the sidewalk, etc.

    b) Two boys shooting some birds with sling shots.

    c) Some children--two of them barefooted--buying cooked food from a sidewalk vendor.

6. Ask children to watch a science fiction story on TV or read such a story as a home assignment. In discussing this in class, listen to children's remarks. Do they reveal critical mindedness?

7. Ask children to make models of things they have studied, as for example, a model of the solar system. Observe if they plan carefully,

suggest effective ways of working out the project, use varied resources to gather the information they need in making the model, show resourcefulness in suggesting materials and procedures to use, are accurate in their measurements and can give meaningful discussion of what they have illustrated.

8. Arrange six or eight objects on a table or desk. Ask the children to study the display for one or two minutes. Cover the display and then ask each member of the class to describe in writing as much detail as possible of as many objects as he can. Repeat the test throughout the semester, increasing the number of items displayed.

9. Ask the children to study an object or picture carefully, as for example, a particular tree, an insect, a bird, a piece of science equipment or science instrument. Then let them list without looking at the object or picture all the items which would be necessary to describe it to someone in a way it would be easily recognized.

10. Ask children to compare two objects or pictures as to their similarities and differences.

11. Plan and take the children on an observation tour to a place of information and interest during the study of a particular unit. Ask the children to jot down and submit a day after the trip their records of observation. Which children saw the most things in the environment? Which children noticed the details in the objects they observed? Who were able to make accurate observations? Who were able to organize and classify their observations?

12. From time to time take note of the children who have acquired good techniques of observation. Watch their behavior as they observe. Which children have learned to give accurate descriptions of what they have observed by:

   a) using instruments? Example: Who used a magnifying glass to be able to give an accurate description of the body structure of an insect?

   b) looking at the object a second or third time?

   c) asking another child to observe the phenomena at the same time in order to check the observation?

   d) checking his readings a second time or asking another child to take the reading?

13. Assign committees to put up a bulletin board display or class exhibit of things they have observed or studied. Does the display or exhibit show evidence of good organization and classification?

14. Listen to the children as they make contributions to the class discussions. Which children were able to use their science vocabulary with accuracy and ease? Who showed evidence of clear understanding of the science content they read?

15. Examine the children's creative work--written compositions, reports, drawings, dioramas, scrapbooks, poems, etc. Do they reveal accurate understanding of science concepts they have studied?

16. Go over the scores the children made in the tests given during and after the study of a unit. High scores usually manifest understanding and interest in the topic studied.

17. Test the children's familiarity with some of the materials suggested for reading by asking them to answer in writing such questions as:

    a) Which of the following materials will tell you why the narra tree was selected as the national tree of the Philippines?

        (1) Science for Children by Banag and Ancheta

        (2) Elementary Science by de la Paz

        (3) Our Philippine Trees by Elmer

        (4) Our Plants, Our Health by Rodrigo and Santiago

    b) Place a check after the materials that give a good discussion about deep sea fishes.

        (1) Stories of Philippine Fishes by Herres

        (2) Our Health and Science World by Mella, Hernandez, Villaflores, and San Jose

        (3) Strange Fishes and Their Stories by Hyatt

        (4) Science For You by Craig and Sheckles

        (5) Science is Adventuring by Blough and Bailey

18. At the end of the study of a unit, ask the children to submit on a sheet of paper:

    a) the names and authors of books, magazine articles, pamphlets, and other reading materials they read.

    b) resource persons they interviewed.

    c) films or slides they viewed.

d. places of interest and information they went to.

Reliability of this report can be checked by the following two procedures (19 and 20).

19. At the end of the period, set aside a few minutes for class evaluation as to who among those pupils who participated in the class discussion made use of information from more than one source. This can be easily noted by the children when they have learned to label the source of their information. Also make them note those who challenge questionable information and accept challenges of their own explanation good naturedly.

20. Examine the children's science notebooks. This may be done with the help of a reliable pupil leader if standards for evaluation have been set and explained. See if the notes taken show evidences of the use of multiple resources.

21. The data obtained from procedures 18 and 20 can be used to determine to what extent children consult reliable sources and authorities for information.

22. Determine the children's growth in the ability to identify reliable sources of information and authorities by presenting situations like the following:

a) If you want to know which toothpaste is best to use, what will you do?

(1) Watch which toothpaste is widely advertised in the papers and TV commercials.

(2) Ask your friends what toothpaste they use.

(3) Ask the druggist which among the toothpastes he sells is the best.

(4) Ask your dentist what toothpaste he can recommend to you.

b) If you want to know more about the planet Mars, which of the following will help you?

(1) TV cartoons about planets

(2) Encyclopedias

(3) Well-illustrated comics

(4) Children's trade books in astronomy

c) A Grade VI class was studying communicable diseases. Someone in the class said that mumps is a highly contagious disease.

The teacher asked, "What reasons can you give for thinking that it is highly contagious?"

Here are the reasons the children gave. Read them carefully and decide which are good and which are poor.

(1) My friend said it is contagious.

(2) One of my brothers was sick of mumps and all of us children got it.

(3) Dr. Torres said it's contagious.

(4) I read a comic strip about Mutt and Jeff getting mumps from Mrs. Mutt.

23. The school librarian's record of reference materials read by the children in the library will show if children are using reliable sources of information.

24. Listen to the contributions children make during class discussions and determine the reliability of the sources of information quoted.

25. Request the school librarian to take note of the children who inquire about the qualifications of authors of books they borrow, who request for up-to-date reading materials, who question inaccuracies or inconsistencies found in printed materials, who consult more than one reference material in studying a certain topic, who distinguish between science books that are read for fun and those that are read for reliable information, who look at the copyright date, and who when information from different sources varies, voluntarily search for the most accurate information.

26. During discussion periods, determine a pupil's opinion. Ask him to state the major reasons for his holding an opinion. When the opinion appears to have been based on hearsay, emotion, gossip, or superstition, provide the pupil with experiences that will help him learn accurate facts and information. Test or watch for evidences of change of his opinion.

27. Observe and make a record of children who consult reliable sources of information after experimenting or observing some objects or phenomena in order to check the accuracy of their generalizations or conclusions.

28. Observe how children use and take care of supplies and equipment when they experiment or do other kinds of manipulative activities.

A few minutes before the end of the science period take note with the help of a pupil monitors evidences of negative behavior, such as:

a) unused or scraps of supplies left on the working tables, scattered on the floor, or thrown in the waste basket.

b) uneconomical use of supplies due to inadequate planning, lack of foresight, or careless action.

c) damage to equipment, apparatus, or devices caused by deliberate or careless actions.

d) careless storage of supplies, devices, and equipment.

e) missing parts of equipment or devices used.

f) leaking faucets, electricity left turned on, cabinets and drawers left open, supplies and parts of equipment not returned to their proper place of storage.

29. Take the children to parks and other places of natural beauty and observe how many of them refrain from (1) injuring the bark of trees, (2) picking flowers, leaves, and seeds, (3) breaking the branches of trees, (4) climbing and picking fruits from trees, (5) trampling plants.

See also those children who step upon insects, catch butterflies and dragonflies with no purpose but to catch them.

30. Make a survey of the co-curricular activities in which children participate. Which children are actively engaged in school and community campaigns such as "Keep Your Community Green" "Help Our Trees and Plants Grow," "Protect Our Animal Friends," etc.

31. Make a record of children: (1) who showed initiative in setting up proposals to solve conservation problems such as preventing soil erosion, (2) who have revealed their awareness of health problems and talked over their ideas with you and with their parents, (3) who have taken responsibility for their own and the safety of others during study trips and when experiments are performed.

32. Examine children's reports of how they believe they have improved in their health practices, data recorded in connection with instruments like "Are You Doing Your Part?" and "Accident Records."

33. Encourage children to keep a log of "what was learned in class" and "how it was applied outside of school."

34. Test the children's commitment to certain health or conservation values by employing the technique of sociodrama.

Examples:

a) Mrs. Cruz was found to be suffering from tuberculosis. She and her husband teach in a private school and have three small children to support.

Assign the role of Mrs. Cruz to a pupil and see how she will deal with the situation.

o) Mang Ambo is a poor fisherman who has not had a good catch for several weeks. One afternoon, Mang Celso came and brought him news about the fortune he was making from dynamite fishing. Mang Celso invited Mang Ambo to join him.

Assign the role of Mang Ambo to a pupil and see how he will deal with the situation.

35. Ask children what activities they enjoy doing when they are not in school or what their favorite hobbies are. Make a record of the children who are interested in planting and taking care of plants, who are keeping a collection of leaves, flowers, insects, sea shells, etc. from their environment, who voluntarily observe things and changes happening in their environment.

36. Observe and make a record of children who voluntarily experiment with seeds and plants, who observe closely and make comparisons about the characteristics of living things, rocks, and kinds of soil in the environment.

37. Study the record of books children have read. Which children have read many books on biological science?

38. Take note of children who are curious and interested in finding explanations of natural phenomena? Who ask questions about happenings they observe and if these are not answered or not answered completely search for explanations? Who when not answered simply forget about the topic?

39. When causes of natural phenomena are discussed in class, which children (1) reject superstitions, myths, magic, astrology, and teleology as explanations but search for more accurate information, (2) use their previous learnings as a basis for interpreting observations?

40. Take note of the pictures, books, toys, projects brought to school by children for classmates to see. Do they show evidence of developing interest in science?

41. Take note of the spontaneous remarks made by children about the things they enjoy doing or would like to do during their leisure time.

42. Examine the creative work done by children. Who of them wrote poems, stories, drew pictures, composed songs with the beauty of nature or the importance of natural resources as themes?

43. Study the diaries of activities, descriptions of experiences, notes on projects carried on in the home, reports of hobbies, library records of voluntary reading and reports of "What I Like To Do." Do they show evidence of interest in science?

44. Take note of those children who report spontaneously or voluntarily science information such as the latest development in space explorations gathered from TV, radio, magazines, or newspapers.

45. Watch the children's behavior during observation tours. Who finds genuine enjoyment of the outdoors? Who sees beauty in the flowers and plants growing in the parks, in the colorful sunset, in the ingenious ways by which animals protect and propagate themselves? Who of the children after the trip have found in nature opportunities to put their feelings into words and other works of art?

46. Listen to the children's spontaneous remarks. Who have verbalized their appreciation for the contributions of science in improving the quality and quantity of farm products, in improving our ways and means of communication, in controlling and preventing common diseases and body illnesses?

47. Examine children's diaries and determine if they experience a pleasant feeling when they take care and watch living things grow, if they enjoy living things in their natural habitat and allow them to remain in their natural surroundings.

48. Test the children's awareness of the work of famous scientists. See if they can associate well-known scientists with their inventions. Make a record of the children who have expressed appreciation for them and their work.

49. Ask the children to write on the topic "The Person I Would Like To Be." How many were inspired by scientists who have made important contributions to our daily lives?

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BIOGRAPHICAL SKETCH

Paulina M. Castaño, daughter of Felix Castaño and Sofia Maglaque, is a native of Manila, Philippines. She obtained her early education in that city and was graduated from the Gagalañgin Elementary School and from the Torres High School with the highest honors. Her undergraduate studies were pursued at the Philippine Normal School where she received the Philippine Normal School teaching certificate in 1937 and at the Arellano University where she received the Bachelor of Science in Education degree in 1947. She received the degree of Master of Arts from the Centro Escolar University in 1955.

In 1959 Miss Castaño was awarded a fellowship by the International Federation of University Women through the Philippine Association of University Women for graduate work in curriculum and instruction with elementary education as her field of specialization. She entered the Graduate School, College of Education, of the University of Florida in the same year and completed work toward the Specialist in Education degree in 1960.

The University of Florida awarded Miss Castaño two fellowships (1960 and 1961) which enabled her to complete the academic requirements for the degree of Doctor of Education. She returned to the Philippines in 1961 to work as elementary school supervisor in the Division of City Schools, Manila and reentered the Graduate School of the University of Florida in 1966.

Miss Castaño has been a classroom teacher, an assistant principal and an elementary school principal. She currently holds the position of elementary school supervisor in the Division of City Schools, Manila, and of part-time associate professor at the Manuel L. Quezon University.

Miss Castaño holds membership in the Phi Kappa Phi, Kappa Delta Pi, and Pi Lambda Theta honor societies.

This dissertation was prepared under the direction of the chairman and co-chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Education and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Education.

August 12, 1967

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